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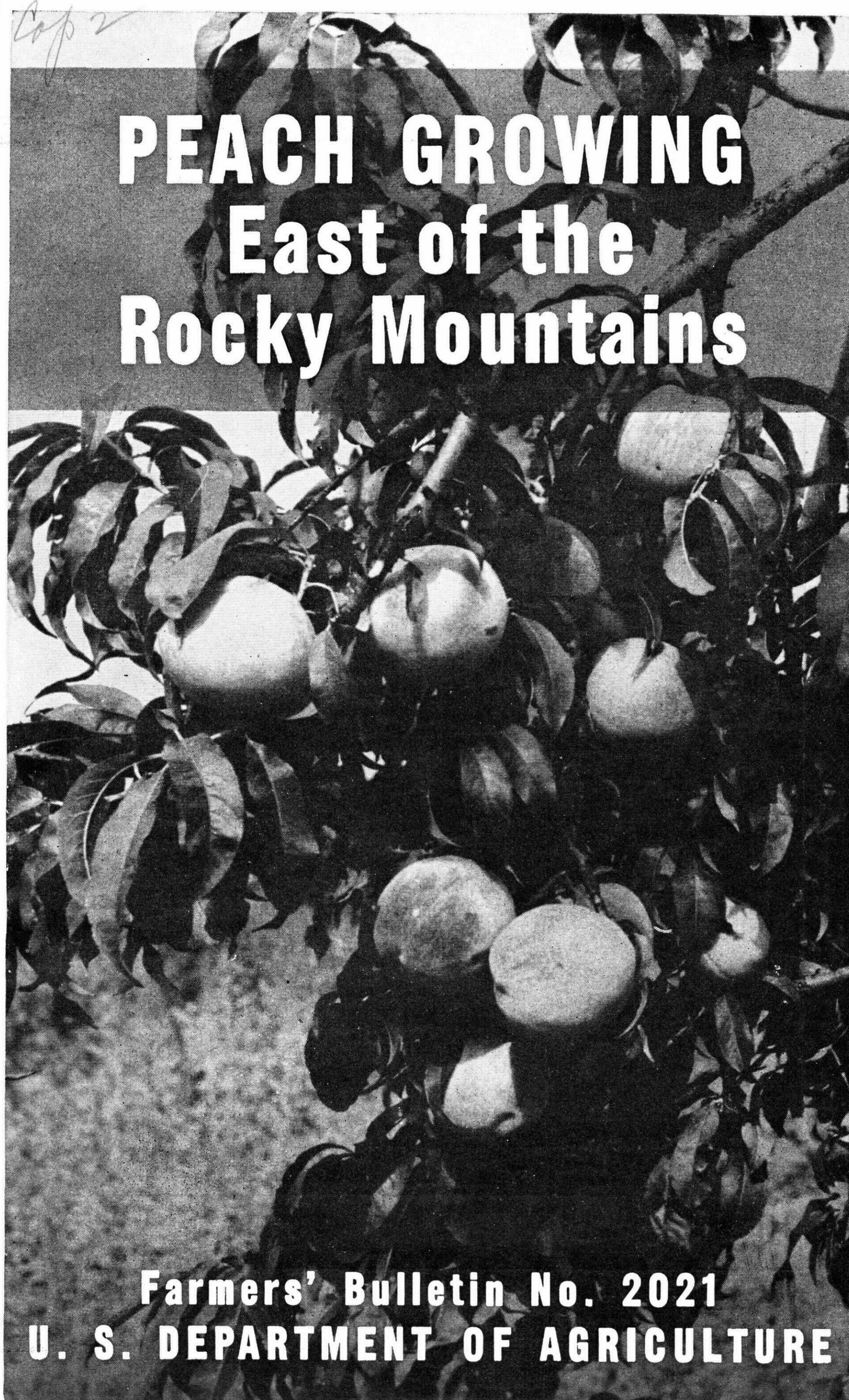
PEACH GROWING East of the Rocky Mountains



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BASIC ADVICE is presented here as a guide to peach growers, particularly those of limited experience.

Although the peach tree does not demand highly fertile soil, it must have good soil drainage and must not be subjected to very low temperatures. Of the peach varieties that have been thoroughly tested, some resist extreme winter cold and late-spring frost distinctly better than others. Such differences are set forth here for a large number of varieties, together with differences among varieties in productiveness and in characteristics of fruit. In addition, approximate dates of ripening are given. Thus growers are helped in choosing not only individual varieties that suit their needs and preferences but combinations of desirable varieties that ripen at different stages of the season.

Dr. Havis tells the peach grower how to give his orchard a good start by correctly preparing a well-chosen site and correctly setting out vigorous nursery trees of suitable varieties; how to shape the young trees by pruning them and how to prune bearing trees in order that the fruiting wood may be amply renewed each year; how to manage the orchard soil in a way that conserves soil and water, encourages good top and root growth of young trees, and assures good nutrition of the trees as the orchard grows older; and how to thin the fruit for highest production and best quality. His coauthors tell how to identify and control the common diseases of the peach caused by fungi and bacteria and the principal peach diseases caused by viruses, how to deal with insect enemies of the peach, and how to harvest and transport the peach crop so as to get it to market in the best possible condition.

This bulletin supersedes Farmers' Bulletin 917, Growing Peaches: Sites and Cultural Methods.

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PEACH GROWING EAST OF THE ROCKY MOUNTAINS

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Contents

A LOCALITY'S FITNESS for peach growing depends most often on its temperatures in winter and at blossoming time. Some of the blossom buds on dormant peach trees are likely to be killed whenever midwinter temperature drops as low as $-5°$ F. At $-15°$ usually almost all peach buds are killed and even the wood may be injured. Rarely do any of the buds survive temperatures much lower than that. Some peach varieties are much more resistant to low winter temperatures than others.

While peach trees do not thrive where winter weather is severe, they definitely require winter chilling. The rest period into which they go after shedding their leaves in autumn must include some cold weather, or the trees will not come out of it satisfactorily. If a peach tree does not have enough chilling during a winter, its shoot growth and blossoming are below normal the next spring.

Frost at blossoming time can destroy a whole peach crop. Danger of crop destruction by frost at that time is not entirely a matter of climate. The peach crop of one orchard may be destroyed by spring

frost and that of another orchard within 100 yards of it left unharmed because the two sites differ in air drainage.

The many localities in the United States that produce peaches on a large scale are indicated in figure 1. Large-scale peach production is practiced in a wide area that begins with New Jersey and the South Atlantic States other than Florida and reaches far into Texas. Peach-producing lands within this area include parts of the Piedmont, which extends from south-central Georgia through the Carolinas, Virginia, and Maryland. In the Carolinas, on the Eastern Shore of Maryland, and through Delaware and New Jersey they include parts of the Coastal Plain. Many large plantings are in production on the borders of the Great Lakes in western New York, northern Ohio, and southwestern Michigan. In the San Joaquin and Sacramento River Valleys of California, climate and soil exceptionally favorable to commercial production of peaches have caused heavy planting. Other centers of peach production in the West, all irrigated, are in south-central Washington, western Colorado, and northern Utah.

Large-scale production of peaches in a certain locality may mean that peaches grow especially well there or may mean only that they grow better there than other crops do.

There are vast areas in this country where peaches do not succeed. Many localities in the North and whole States in the Great Plains and the Rocky Mountain region have winters so cold that only the hardiest peach varieties survive and even these often fail to bear. In south Georgia, throughout Florida, and in southern parts of all the other States bordering the Gulf or Mexico, none of the more important peach varieties produce well enough to be grown commercially, because there the winters are too warm for them.

During the 10-year period 1935–44, annual peach production in the United States averaged about 60,000,000 bushels. In 1945–49 it

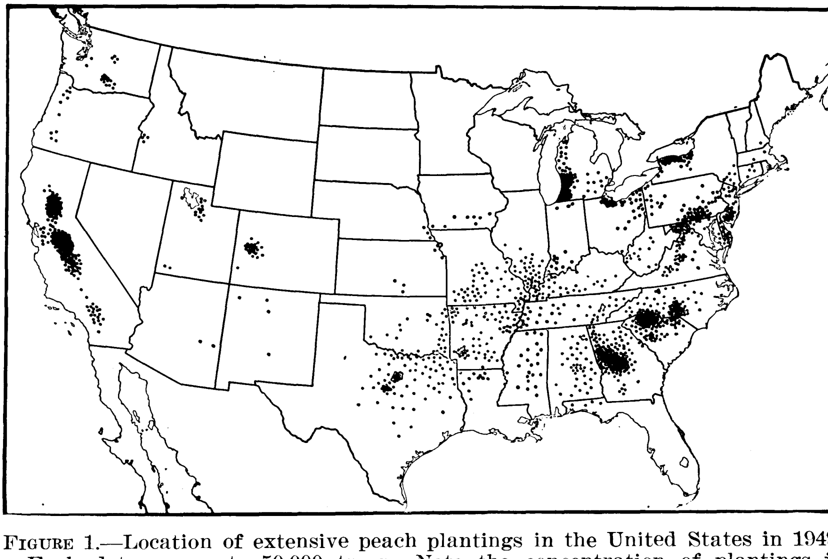

FIGURE 1.—Location of extensive peach plantings in the United States in 1949. Each dot represents 50,000 trees. Note the concentration of plantings in California, Georgia, and South Carolina and near the Great Lakes.

reached its highest 5-year average, 78,200,000 bushels. The highest-producing States and their approximate average annual yields for the 5 years 1945–49 are California, 33,600,000 bushels (including both freestones and clings); South Carolina, 4,900,000 bushels; Georgia, 4,800,000 bushels; Michigan, 4,400,000 bushels; North Carolina, Arkansas, and Washington, 2,500,000 bushels each. Improvement of peach varieties and of methods of canning, freezing, and transportation are increasing the quantities of peaches consumed in the United States; nevertheless, in view of the present high national production, establishing a new commercial peach orchard calls for very careful planning.

SELECTION OF PEACH SITES

Anyone selecting a site for a peach orchard should consider very carefully the elevation, topography, and slope of the land and the depth, moisture-holding capacity, and other physical features of the soil. Satisfactory sites are found on hilly and also on rather level land. On level land, nearness to a large body of water such as an inland lake is a favorable factor.

In the peach-producing localities of the South Atlantic and South Central States, few sites ever have winter temperatures low enough to injure dormant flower buds but on many sites fruit crops may be lost as a result of frosts at blossoming time. In the New England, Middle Atlantic, and East Central States, sites for peach orchards must be judged from the standpoint of protection not only against spring frosts but also against severe winter cold.

Orchards on sites having poor air drainage are the ones most likely to suffer from winter cold and spring frost. On clear, cold, still nights, when heat is lost from the earth by radiation, warm air rises and is replaced, on a level area or at the foot of a slope, by a layer of cold air near the ground. Part way up a slope or, generally, on a hilltop the corresponding layer of air is warmer. A difference of 50 to 75 feet in elevation may mean a difference of several degrees in temperature at the critical period of a frosty night. If air movement is slowed down by a ridge or by trees, cold air may accumulate in pockets on slopes. In most localities, therefore, the site for a peach orchard should be on land elevated above adjacent land, and free of obstructions to air movement, to such an extent that cold air drains from it to lower levels. Gently sloping or level land may be satisfactory where the climate is mild or where natural protection from cold is afforded by a nearby body of water.

An orchard on the leeward side of a large body of water is often protected from spring frost because the temperature of the great mass of water has an equalizing effect that prevents sudden deep drops in the air temperature. Examples of this are found on a strip of land 10 to 15 miles wide along the east shore of Lake Michigan and a strip of similar width along the south shore of Lake Ontario. Masses of cold air blowing over these lakes are warmed by the water. Also, air movement across the cold water in early spring tends to prevent sudden rises in air temperature that would cause peach blossoms to open too early and as a result be injured by later low temperatures.

While a peach-orchard site should, in general, be at an elevation greater than that of some land adjoining it, location on a hilltop is a

disadvantage if it means exposure to cold, drying winds during the winter. Peach trees planted on sites exposed to strong prevailing winds not only are subject to damage by cold but often become permanently bent. This is especially noticeable in young orchards where heavy rains have softened the soil and have been accompanied by high winds.

It should be borne in mind that one site at a given elevation may be satisfactory for a peach orchard although a site at the same elevation elsewhere is wholly unsuited for this use.

An orchardist who considers planting peach trees on a site with which he is not familiar is advised to find out in advance something about the lowest winter and spring temperatures that are likely to occur on it. This he can do by setting out at different elevations on the site several thermometers of the type that automatically records minimum daily air temperature.

Peaches do well on a great variety of soils ranging from coarse sands and shales to fine-textured clay loams. In general, they will not grow so well on heavy soils as apples and pears. Soils poorly drained or poorly aerated are not satisfactory. During their growing season, peach trees are very likely to be injured if the orchard water table is temporarily raised by heavy rains or by accumulation of irrigation water. Where free water in the soil does not drain off quickly by gravity but accumulates and fills the pore spaces between soil particles, it cuts off the oxygen supply to the roots with the result that the roots cease functioning and die. Especially where soil becomes saturated with water soon after peach trees start growing in the spring, resulting injury to the trees is often indicated by yellowing

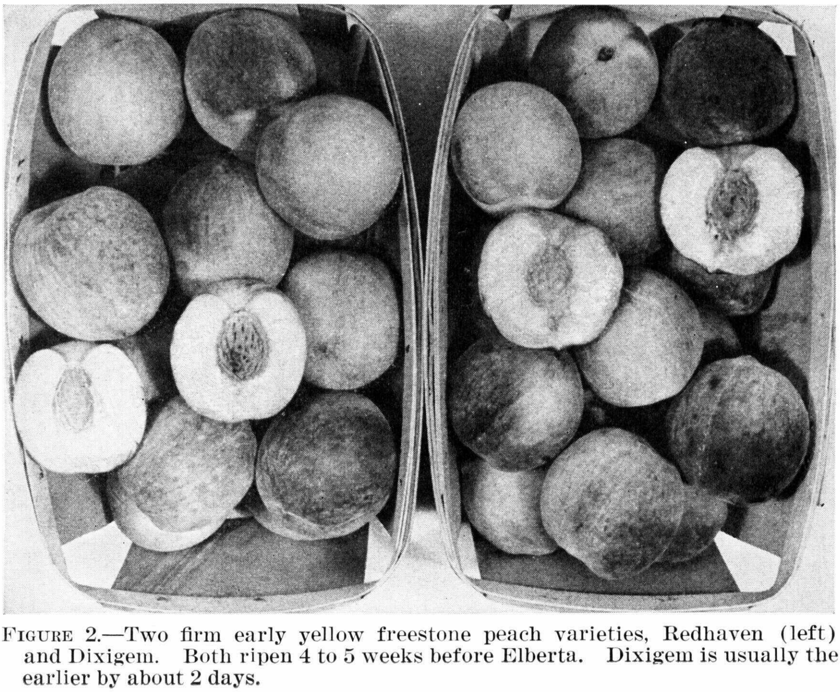

FIGURE 2.—Two firm early yellow freestone peach varieties, Redhaven (left) and Dixigem. Both ripen 4 to 5 weeks before Elberta. Dixigem is usually the earlier by about 2 days.

of the foliage. On water-saturated soil winter injury to peach trees is frequently severe and may result in early death of the trees. Most peach orchards are on well-drained sandy or gravelly loam soils.

The lighter soils (such as the coarse sands, gravels, and shales), although they usually have better aeration and drainage, may not drain well if underlain by impervious clay, hardpan, or rock. In such a situation, too much free water may accumulate near the root zone of peach trees after heavy summer and fall rains. The fact that the lighter soils do not hold and store so much water as the heavier soils is not always an advantage in localities where summer droughts occur and irrigation is not practiced. Peach trees require an unfailing, readily available supply of water for satisfactory growth and fruit production.

A soil that might be considered ideal for peaches is a sandy loam about 8 feet deep underlain by a clay loam capable of retaining and storing the greatest possible part of the rainfall.

Sites on hillsides, besides having good air drainage, are often very satisfactory as to surface drainage of excess rain water. On some such sites the soil is only 3 to 4 feet deep. In the humid regions, with rainfall averaging 3 to 4 inches a month in the growing season, this depth of soil will support peach tree growth. In a region where rainfall may be short for periods of 4 to 6 weeks in the summer, coarse soils of this depth cannot store enough water to meet the needs of the trees.

SELECTION OF VARIETIES

New peach varieties are being developed very rapidly. In this bulletin it is impossible to describe more than a few of the standard varieties and of the outstanding new ones. No attempt is made here to recommend definite lists of varieties for growing in different parts of the country. Local conditions and the purpose or market for which the peaches will be grown largely determine which varieties should be selected. If someone is going to grow peaches for sale in a nearby market, for example, he needs a series of high-quality varieties that ripen at different stages of the season rather than varieties that are especially good for shipping. In many sections the first question that must be answered regarding the suitability of a peach variety is whether its flower buds are hardy in the local climate. Table 1 lists 48 peach varieties now grown commercially east of the Rocky Mountains, according to approximate order of ripening, and summarizes their outstanding characteristics. Elberta is by far the leading variety, with Halehaven and Golden Jubilee in second and third places. Recent development of firmer and higher-quality early ripening varieties (fig. 2) has led to greater use of early varieties.

STANDARD COMMERCIAL VARIETIES

The following peach varieties, listed in approximate order of ripening, are suggested for general commercial purposes east of the Rocky Mountains:

Redhaven.—Early, ripening 4 to 5 weeks before Elberta. Fruits require early and heavy thinning to develop to best size. Skin a bright, attractive red, flesh yellow. Usually freestone when ripe. Excellent for canning and freezing. Flower buds moderately hardy. Variety becoming more and more popular because of fruit's firmness, attractiveness, and earliness.

Table 1.—*Characteristics of principal and some new peach varieties for*

Part of ripening season, and variety (in approximate order of ripening)	Approximate average ripening date, in days before or after Elberta [1]	Color of flesh	Fruit size	Dessert quality	Canning quality
Very early:					
Mayflower	−58	White	Small	Fair	Poor
Mikado (June Elberta).	−49	Yellow	Medium	Fair	Poor
Dixired	−42	Yellow	Medium	Fair to good	Poor
Marigold	−38	Yellow	Medium	Fair	Poor to fair
Erly-Red-Fre	−36	White	Large	Fair	Poor to fair
Greensboro	−36	White	Medium	Fair	Poor
Early Rose	−35	White	Medium	Fair	Poor
Jerseyland	−34	Yellow	Medium	Fair to good	Good
Early:					
Dixigem	−33	Yellow	Medium	Good	Very good
Redhaven	−31	Yellow	Medium	Good	Very good
Oriole	−31	Yellow	Medium	Fair to good	Fair
Raritan Rose	−28	White	Medium to large	Good	Fair
Cumberland	−26	White	Medium to large	Good	Fair
Golden Jubilee	−26	Yellow	Medium	Good	Good
Carman	−25	White	Medium	Fair	Fair
Rochester	−24	Yellow	Medium	Good	Good
Early Halehaven	−23	Yellow	Medium	Good	Fair to good
Fairs Beauty	−22	Yellow	Medium to large	Good	Fair to good
Triogem	−22	Yellow	Medium	Good	Good
Midseason:					
Fairhaven	−19	Yellow	Medium to large	Good	Good
Early Hiley	−19	White	Medium	Fair to good	Fair
Sunhigh	−16	Yellow	Large	Good	Good
Vedette	−15	Yellow	Medium	Very good	Very good
Southland	−15	Yellow	Medium to large	Good	Good
Goldeneast	−15	Yellow	Large	Good	Good
July Elberta	−15	Yellow	Large	Good	Very good
Ambergem	−14	Yellow	Medium	Good	Very good
Halehaven	−14	Yellow	Large	Good	Good
Valiant	−14	Yellow	Large	Good	Very good
Hiley	−13	White	Medium to large	Fair to good	Fair
Veteran	−12	Yellow	Medium to large	Very good	Good
Belle (Belle of Georgia).	−7	White	Medium to large	Good	Fair to good
Sullivan Elberta	−7	Yellow	Large	Fair	Fair to good
Champion	−6	White	Large	Very good	Fair to good
Early Elberta	−4	Yellow	Large	Good	Good
Elberta	0	Yellow	Large	Fair	Fair to good
J. H. Hale	+2	Yellow	Large	Good	Fair to good
Shippers Late Red	+3	Yellow	Large	Good	Fair to good
Late:					
White Hale	+4	White	Large	Good	Fair
Fertile Hale	+4	Yellow	Large	Fair to good	Fair to good
Afterglow	+5	Yellow	Large	Good	Fair to good
Rio Oso Gem	+5	Yellow	Large	Good	Good
Gemmers Late Elberta.	+5	Yellow	Large	Good	Good
Laterose	+6	White	Medium to large	Good	Fair to good
Salberta	+8	Yellow	Large	Fair to good	Fair
Lizzie	+13	Yellow	Medium	Fair to good	Fair to good
Very late:					
Salwey	+18	Yellow	Medium	Fair to good	Fair
Krummel	+28	Yellow	Medium to large	Fair	Fair

[1] The ripening dates of early ripening varieties and those of late ripening varieties vary considerably from year to year in relation to that of Elberta, but the dates of the varieties in any one of the five groups are fairly uniform as related to each other. For example, the ripening dates in any one year for Dixigem and Redhaven may differ from that of Elberta by several days more or several days less than 33 and 31 days, respectively, but are usually 2 days apart.

use east of the Rocky Mountains, listed in approximate order of ripening

Stone freeness	Skin color	Flesh texture	Flesh firmness	Principal use [2]
Cling	Medium red (75- to 100-percent blush).	Medium fine	Soft	H, L, and C.
Cling	Medium red	Medium	Soft	H and L.
Cling	Bright red, striped	Medium fine	Medium firm	H, L, and C.
Cling until soft ripe	Medium red	Medium	Medium soft	H and L.
Partly cling until ripe	Bright red	Medium fine	Medium	H, L, and C.
Cling until soft ripe	Medium red (to 50-percent blush).	Medium	Medium soft	H and L.
Cling	Bright red	Medium	Firm	C.
Usually free	Medium, solid red	Medium	Firm	L and C.
Usually free	Light to medium red	Fine	Firm	L and C.
Usually free	Bright red	Fine	Firm	L and C.
Partly cling until soft	Medium red	Medium	Soft	L.
Free	Bright red (to 75-percent blush).	Fine	Medium soft	L.
Usually free	Medium-red blush	Medium fine	Medium soft	L.
Free	Medium-bright red (to 75-percent blush).	Medium fine	Medium soft	L.
Usually free when soft	Medium blush	Medium	Medium soft	L.
Free	Deep-red blush	Medium fine	Medium	C.
Usually free	Dark red (to 100-percent blush).	Medium	Medium soft	L.
Partly cling until soft	Bright red (to 75-percent blush).	Medium fine	Medium firm	C.
Usually free	Bright red (to 100-percent blush).	Fine	Firm	L and C.
Free	Bright red	Medium fine	Medium firm	L and C.
Usually free	Bright red (to 65-percent blush).	Medium fine	Medium soft	C.
Usually free	Light, solid red	Fine	Firm	C.
Free	Medium blush	Medium	Medium	L and C.
Free	Medium blush	Medium	Firm	C.
Usually free	Medium-bright blush	Medium	Medium firm	C.
Free	Medium blush	Medium	Medium	C.
Cling	Medium blush	Fine	Firm	C.
Free	Medium to dark blush	Medium	Medium	H, L, and C.
Free	Medium-light blush	Medium	Medium soft	L and C.
Free	Medium-bright blush	Medium	Medium	C.
Usually free	Light blush	Medium fine	Medium	L and C.
Usually free	Medium-bright blush	Medium fine	Medium soft	L and C.
Free	Medium blush	Medium	Firm	C.
Usually free	Medium-bright blush	Fine	Medium soft	L and C.
Free	Medium blush	Fine	Medium firm	C.
Free	Medium blush	Medium	Firm	C.
Free	Medium to bright blush	Fine	Firm	C.
Free	Medium to bright blush	Medium	Firm	C.
Free	Medium blush	Medium	Firm	C.
Free	Medium blush	Medium	Firm	C.
Free	Medium to light blush	Medium	Firm	C.
Free	Medium to bright blush	Medium fine	Firm	C.
Free	Medium blush	Medium	Firm	C.
Free	Medium to bright blush	Medium fine	Medium firm	L and C.
Free	Medium blush	Medium	Medium firm	C.
Free	Light blush	Medium fine	Medium firm	C.
Free	Medium blush	Medium	Firm	C.
Free	Medium-dark blush	Medium	Firm	L and C.

[2] H=home; L=local market; C=commercial market.

Golden Jubilee.—Early, ripening 3 to 4 weeks before Elberta. Fruits medium-sized, with attractive red and yellow color. Shape compressed, especially in southern areas. Flesh yellow, free, and medium soft. Not firm enough for distance shipping. Flower buds fairly hardy. Fruits should be thinned early and well. Valuable where hardiness is important and market is nearby.

Triogem.—Early, ripening about 3 weeks before Elberta. Fruits medium-sized, with attractive skin color. Flesh yellow, fine-textured, usually free, and firm. Flower buds tender to low temperature. Fruit may be small unless thinned well and early. Principal merits firm flesh, high quality, and attractiveness of fruit.

July Elberta.—Midseason, ripening about 2 weeks before Elberta. Fruits large, round. Flesh yellow, free, and fairly firm. Trees productive. Chilling requirement short. One of best commercial varieties for its season in several peach areas.

Halehaven.—Midseason, ripening 2 weeks before Elberta. Fruits large, round. Skin color sometimes too dull. Flesh yellow, free, and fairly firm for season. Flower buds fairly hardy. Trees vigorous and productive. Fruit set often heavy, making detailed thinning necessary. Although Halehaven lacks the shipping qualities of Elberta and J. H. Hale, it has been one of the most outstanding varieties introduced in recent years for commercial planting. It may well be used for local markets and home planting, also.

Belle (Belle of Georgia).—Midseason. Flesh white, of high quality, usually free. Skin sometimes lacking in color. Flower buds hardy. Usually preferred as a white variety ripening just before Elberta, but not planted extensively.

Sullivan Elberta.—Midseason, ripening 1 week before Elberta. Fruits large. Similar to Elberta in all respects except earlier ripening. One of the most extensively planted varieties in the last few years, especially in the Southeast.

Early Elberta (Gleason).—Midseason, ripening usually 3 to 4 days before Elberta. Fruit slightly smaller than Elberta and more attractive as to ground color. Flower buds tender to low temperature. Has long been and remains an important commercial variety to ripen just before Elberta.

Elberta.—Midseason. Fruits large, with red blush. Flesh yellow, free, firm, of fair to good quality. Flower buds tender to low temperature. Trees productive. By far the leading peach variety in the United States. Its popularity with growers is due to the large size, firmness, attractiveness, and shipping quality of its fruit, the vigor of the trees, and its suitability to many soil and climatic conditions. Although Elberta should still be considered the principal commercial midseason variety, midseason varieties superior to it in quality, hardiness, and skin color are being planted in numerous orchards.

Salberta.—Late, ripening about 1 week after Elberta and of similar type. Fruits large. Skin has little red. Flesh similar to that of Elberta. Flower buds tender to low temperature. Most serious fault is usually lack of enough skin color. Demand limited.

SPECIAL-PURPOSE VARIETIES

Varieties suggested for special purposes, for certain localities, or to extend the ripening season are these (listed in approximate order of ripening):

Mayflower.—Very early, ripening about 8 weeks before Elberta. Fruits small. Skin mostly red. Flesh white, cling, soft, juicy. Yields usually low. Early ripening the only important merit.

Dixired.—Very early, ripening 5 to 6 weeks before Elberta. Fruits medium-sized. Skin bright red. Flesh yellow, cling, medium firm, melting. Promising for very early shipping or for local marketing where earliness is of prime importance and a cling variety is acceptable. Considerable acreage planted in Southeast.

Erly-Red-Fre.—Very early, ripening 5 weeks before Elberta. Fruits large for early season. Skin bright red. Flesh white, usually free when fully ripe. Trees fairly productive. Becoming more popular, mainly because of fruit's early ripening, size, and color. Flower buds hardy to low winter temperatures.

Dixigem.—Early, ripening 4 to 5 weeks before Elberta and about a week before Golden Jubilee. Fruits medium-sized. Light to medium red over about half the skin surface, ground color bright yellow. Flesh yellow, usually free when ripe, firm, fine-textured. Suggested as an early shipping variety, and for local sale where an early yellow peach is needed.

Raritan Rose.—Early, ripening 4 weeks before Elberta. Skin an attractive red. Flesh white, free, fine-textured. Fairly hardy and productive. Has special merit for local sale where an early white variety is desired.

Rochester.—Early, ripening 3 weeks before Elberta. Skin dark red, very fuzzy. Flesh yellow, free, of high quality. Flower buds very hardy. Thorough pruning and thinning necessary to obtain fruit of satisfactory size. Losing favor except where bud hardiness is of prime importance.

Sunhigh.—Early midseason. Fruits large, attractive. Skin light, solid red. Flesh attractive, fine-textured, yellow, usually free, firm. Buds fairly hardy to low winter temperature, but apparently tender to low temperature in early spring. Susceptible to bacterial spot. Relatively short chilling sufficient. Principal merits firmness, size, and attractiveness of fruit.

Southland.—Early midseason, ripening 2 to 3 weeks before Elberta. Fruits medium-sized to large, round. Skin has medium blush, yellow ground color. Flesh yellow, free, firm. Good for freezing and canning. Chilling requirement low. Southland is being planted extensively, and has special promise as a shipping variety in the South.

Vedette.—Early midseason. Fruits medium-sized, sometimes lacking in firmness. Flesh attractive, yellow, free, of excellent quality. Flower buds hardy to low winter temperature and spring frost. Trees sometimes low in productiveness. Not being planted extensively.

Goldeneast.—Early midseason. Fruits large, attractive. Flesh yellow, usually free, of good quality, fairly firm. Flower buds tender to low temperature. Trees susceptible to bacterial spot. Rather long period of chilling required. In spite of weaknesses, Goldeneast has been profitable in some regions because of fruit's size and relative firmness.

Ambergem.—Early midseason. Fruits medium-sized, round. Flesh yellow, nonmelting, cling, firm, fine-textured. Flower buds hardy to low winter temperature—slightly more so than those of Halehaven. Trees productive. Usually planted for canning purposes. Preferable to western clingstone varieties for planting east of Rocky Mountains.

Champion.—Midseason. Flesh white, of excellent dessert quality, fine-textured, usually free. Fruits lack firmness. Flower buds very hardy to low temperature. Susceptible to brown rot.

J. H. Hale.—Midseason, ripening with or just after Elberta. Fruits large. Skin color an attractive red. Flesh yellow, free, of high dessert quality, firm, fine-textured. Flower buds tender. Cross-pollination necessary to fruit setting. Trees lacking in vigor, often not productive, and very susceptible to bacterial spot. Often unprofitable to grower in Eastern States, though fruit may bring a premium because of high quality.

White Hale.—Late, ripening a few days after Elberta. Fruits large, with attractive color. Flesh white, free, of high dessert quality, firm. Flower buds tender. Trees productive. Susceptible to brown rot and bacterial spot. Should be used commercially only where a late white variety is especially needed.

Afterglow.—Late, ripening nearly a week after Elberta. Fruits large. Medium to light blush. Flesh yellow and firm. Flower buds fairly tender. Trees moderately vigorous and productive. Although usually not so well-colored as Rio Oso Gem, Afterglow is sometimes preferred to it because of greater tree vigor and slightly greater flower-bud hardiness.

Rio Oso Gem.—Late, ripening with Afterglow. Fruits large. Medium to bright blush. Flesh yellow, free, of good quality, firm. Flower buds tender to low temperature. Trees rather weak, moderately productive. Susceptible to bacterial spot. Popular with many growers because of fruit's size, firmness, attractiveness, and time of ripening.

Lizzie.—Late, ripening about 2 weeks after Elberta. Fruits medium-sized and lacking in skin color. Flesh medium firm, yellow, of fair to good quality. Flower buds tender. Greatest drawback, lack of skin color. Limited plantings.

Salwey.—Very late, ripening nearly 3 weeks after Elberta. Fruits medium-sized. Flesh firm, yellow, of fair quality. One of the best for its season, in which demand for peaches is limited even where they ripen well.

SOME PROMISING NEW VARIETIES

There are a great many new peach varieties that give promise but have not been tested enough to be described with confidence. Some of the more promising new varieties are described briefly here, in approximate order of ripening.

Jerseyland.—Very early, ripening about 5 weeks before Elberta. Fruits medium-sized, round. Skin solid red. Flesh yellow, usually free when ripe, firm. Promising for local marketing and commercial production.

Prairie Dawn.—Early, ripening 4 to 5 weeks before Elberta. Fruits medium-sized. Skin bright red. Flesh yellow, usually free when ripe, fairly firm. Flower buds hardy to low winter temperature.

Prairie Sunrise.—Early, ripening with or a few days after Prairie Dawn. Flesh yellow. Has not been tested extensively.

Wildrose.—Early, ripening with and just after Golden Jubilee. Fruits medium-sized, oval. Skin an attractive red. Flesh white, fairly firm, free.

Fairhaven.—Early midseason, ripening after Golden Jubilee and about 3 weeks before Elberta. Flesh yellow, free. Good for freezing and canning. Limited tests indicate promise for local marketing and commercial production.

Prairie Rose.—Early midseason, ripening just before Halehaven. Fruits medium to large, round. Skin well-colored. Flesh firm, yellow, free, of good quality.

Redskin.—Midseason, ripening about the same time as Elberta. Fruits large, round. Skin an attractive, almost solid bright red. Flesh yellow, free, firm. Good for freezing and canning. Promising as a commercial variety particularly because of fruit's color and quality.

Gemmers Late Elberta.—Late, ripening soon after Elberta. Fruits large, round. Skin color attractive. Flesh firm, of good quality. Promising for commercial use.

Laterose.—Late, ripening soon after Elberta. Fruits medium-sized to large, oval. Skin well-colored. Flesh medium firm, white, free, of good dessert quality. Promising for its season.

Goodcheer.—Late, ripening about 10 days after Elberta. Fruits medium-sized to large, ovate. Skin an attractive red. Flesh firm, yellow, free, of good quality. Promising to prolong the season of Elberta-type peaches.

PROPAGATION

The average peach grower finds it to his advantage to purchase his trees directly from a reliable nursery rather than to propagate them himself. Propagating trees is the business of the nurseryman, and he has a large stock of trees from which the grower can select the size and grade he requires. Nevertheless, a peach grower may want to propagate some of his own trees for some special purpose such as reproducing a particular variety, either new or standard.

A peach variety cannot be reproduced reliably from its seed. Plants grown from seeds of a particular peach tree may differ considerably from it even though there has been no cross-pollination. For some varieties the progenies are more uniform than for others. In all reliable nurseries the principal purpose of germinating peach seed is to grow young trees, or understocks, on which to bud desired

varieties. A few years ago most of the seed used in growing peach understocks came from seedling peach trees grown in the Carolinas, Tennessee, and Kentucky and elsewhere in the South. The supply of reliable seed from these sources has dwindled, and understocks are now grown largely from seed of a variety used in California for drying, the Lovell. Seed of any other common peach variety that has a high germination percentage and a desirable growth habit can be used just as satisfactorily for propagating a small number of trees. One reason Lovell seed are commonly used is that they are available in large quantities. Seed of the midseason or later varieties, such as Elberta, Brackett, Salwey, and Krummel, germinate more dependably than those of early varieties.

Peach seed must have a rest period of about 3 months (the length of time depends on the variety) before they can be expected to germinate satisfactorily and produce vigorous seedlings. One of the best methods of treating the seed is to store them over winter in damp peat, sand, or a mixture of the two at a temperature of 35° to 40° F. Such treatment is called stratification. Sometimes the seed are stratified outdoors in the fall in moist sand. Frequently they are stratified in underground pits; some nurseries use this method. It is not necessary that the seed freeze, but it is necessary that they be kept cool and moist. Early in the spring, after any of the winter treatments outlined, the seed are planted in rows in the nursery or garden.

The more common practice is to plant peach seed in the field in the fall, at a depth of about 2 inches, in rows about 4 feet apart. Seed so planted germinate the following spring. Too much moisture, as when the soil is poorly drained, injures the seed and prevents good germination. Special precautions must sometimes be taken with this method to avoid destruction of the seed by rodents.

Budding of desired peach varieties onto young seedlings is done during the first year of seedling growth. June is often the time chosen for peach budding in the South, and late July or August in the North. The shield, or T-budding, method is used. A T-shaped cut is made near the base of the seedling, and a shield-shaped section of the bark of a tree of the desired variety containing one bud is inserted into it. The bud is then bound firmly in position with rubber bands, strips of raffia, or string. The rubber bands seem preferable. If string or raffia is used it should be cut as soon as the bud has set, to prevent girdling. When the inserted bud starts growth, the seedling is cut off just above it. This is done soon after June budding, and early the next spring after late-summer budding. All growth except from the desired bud is kept removed.

PLANTING THE ORCHARD

AGE AND SIZE OF TREES

Nursery peach trees 1 year old are the most satisfactory to plant. The term "1-year-old tree," as used here, refers to a tree that has had one complete season's growth in the nursery since it was budded. A tree that is budded early in the first summer, as many are in the South, is dug at the end of the same season. In this case the tree is commonly referred to as a June bud. June-budded trees are smaller than most 1-year-old trees, but are satisfactory for planting in peach-growing regions that have long growing seasons. They may be

straight, unbranched whips or may have a few branches, whereas 1-year peach trees are usually well-branched.

Nurserymen who propagate large numbers of peach trees grade them according to height in feet or diameter in fractions of an inch. Well-grown June buds are usually 2 to 3 feet tall and occasionally somewhat taller. For general-purpose planting the medium-sized (4- to 6-foot) 1-year tree or the largest June bud is satisfactory. It is not always good economy to buy a small tree just because it is cheaper.

TIME TO PLANT

Well-hardened dormant peach trees may be transplanted from the nursery to the orchard in late fall, winter, or early spring. Generally speaking, the best time for transplanting them is late fall or early winter in the Southeast and the Southwest, late fall in the Middle Atlantic and Middle South Central States, and late winter or early spring in New England and the North Central States.

Where temperatures below zero accompanied by high winds are likely to occur and where soil without a snow cover freezes to a considerable depth, fall-planted trees may dry out considerably and be injured by cold. Trees planted in late winter or early spring should be set out as soon as the soil is dry enough to work, so that they may make new root growth and become established while soil temperatures and moisture are favorable. Trees planted late in the spring, especially if they are large, may lose as much moisture as fall-planted trees. High mortality of peach trees often results when the trees are set out late in the spring. Leaf buds of the transplanted trees open when temperatures become favorable, and if the newly developed root systems cannot absorb enough moisture and nutrients for growth the trees may be killed by spring or summer drought. It is important, therefore, that spring-planted trees be set out about 3 to 4 weeks before the leaf buds are likely to make much growth.

If transplanting is done late in the spring, small and medium-sized trees may show less mortality than larger trees at the end of the first season in the orchard. If large (5- to 7-foot) trees are planted in the fall or in late winter at least a month before growth starts, their mortality will be no greater than that of smaller trees planted at the same time and they will make greater growth during their first year in the orchard than the smaller trees.

If the time when seedlings are received from the nursery is unsuitable for planting because of soil or weather conditions, they should usually be heeled in outdoors to prevent drying out. "Heeling in" means laying the trees on the side of a trench in a sloping position and covering their roots with soil. If planting must be delayed for any length of time, the soil should be packed tightly around the roots. If the trees are to be left unplanted for only a short period, they may be protected sufficiently by wrapping some material such as burlap, excelsior, or old straw around their roots, thoroughly moistening this cover with water, and shielding them from wind and sun.

PLANTING PLANS AND DISTANCES

Peach trees are usually set out in some rectangular pattern. In rectangular plantings, tillage and other kinds of cultural work can be carried on both along and across the rows. Where the land is level or has a slope of not more than 5 feet per 100, the square system is com-

monly used; that is, the distance between trees in the row is made the same as the distance between rows.

The value of contour planting and terracing as means of conserving soil and water in peach orchards has been established for a number of regions where the soil is easily erodible. On steep slopes and irregular land, it is advisable to plant on the contour. In contour planting the trees are set about the same distance apart within the row but each row follows a true contour line (that is, a level line) or else a line sloping so little that water cannot carry soil along it. The distance between any row of trees and the next one in a contour-planted orchard varies with the degree of slope of the land. In such an orchard cultivation is carried on only along the rows, never up and down the slope. By cultivating in one direction and working the soil toward the trees a contour ridge is built up along each tree row. The principal advantage of the contour method of planting is that soil erosion, often serious in cultivated orchards planted on the square system on sloping sites, is reduced to a minimum. By this method, rain water that would otherwise flow down the slope is checked in its movement and caused to percolate into the soil. Where the slope is steep or where there is a broad watershed above the orchard from which a large amount of accumulated water may flow down into the orchard during heavy rains, it may be desirable to build terraces. Terraces check the flow of such water down the slope, thus cause much of it to percolate into the soil, and divert the remainder into drainage ditches or flumes. It is much better to plan a system of terraces before rather than after the orchard is planted.

Help in planning the lay-out of a contoured, terraced orchard site can be obtained from the Soil Conservation Service or from State and county agents who are familiar with this work.

For commercial peach production, trees should not be set closer than 20 by 20 feet if the orchard is planted on the square. Even trees planted this far apart are frequently crowding each other when they reach the age of 8 years. A better distance to allow for full development of the trees is 24 by 24 feet; and 20 by 25 feet or even 25 by 25 feet or more is to be preferred to 20 by 20 feet on fertile soils capable of producing vigorous trees. The wider spacing permits using tractors and other power-driven machinery for hauling harrows and spray equipment without severely breaking trees and scarring branches. Where trees are planted on the contour, greater distance between rows permits better tree spacing. Trees planted to grow fruit for home use or where the area available for an orchard is limited may be spaced even 15 by 20 feet. At the closer planting distances, trees may be kept within bounds by pruning. This may reduce the amount of fruit they will produce, but trees of many varieties may still yield satisfactorily for home consumption or local marketing.

PREPARING THE SITE

On soils that are not very fertile (many of the upland soils usually are not), it is a good practice to turn under some green-manure crop before planting a peach orchard.

If the site is level or only gently sloping, the soil may be disked or plowed before the trees are set out. Where the trees are to be planted on the contour or where terracing between rows is necessary,

tilling in preparation for planting may be confined to strips containing the tree rows, leaving the land between these strips unbroken. Often on large peach areas a deep furrow is prepared for each row of trees.

The orchard may be laid out with a transit or measured for each row and each tree location, either from a measured base line or by means of a steel tape, and the tree locations staked.

When the rows have been laid out for planting, holes are dug for the trees. This digging requires very little effort on an area that has been furrowed for planting. The holes should be 18 inches in diameter or larger, and of a depth corresponding to the size of the root systems of the trees to be planted.

Details of methods to be used in laying out an orchard on the contour and terracing it can be obtained from the local county agricultural agent or from the Soil Conservation Service.

SETTING OUT THE TREES

Before peach trees are planted, any broken or diseased roots may be pruned off. Any further root pruning is not necessary or desirable. If the roots of any of the trees have dried out in storage or in transit, they should be soaked in water for several hours. Care should be taken to keep the roots of the trees from drying out during the planting operation.

In setting out a tree the planter holds it in place in the hole at a level about 2 inches lower than that at which it grew in the nursery

FIGURE 3.—Planting a peach tree: *A*, Placing the tree in the hole; *B*, tamping topsoil around the roots.

(fig. 3, *A*), and fills soil into the empty space around the roots. Since topsoil contains more organic matter and mineral nutrients than subsoil, he uses it for this filling in. Still holding the tree upright, he tamps the soil down around its roots (fig. 3, *B*), to bring soil particles into contact with the roots. Above the firmed topsoil he shovels in additional topsoil if it is conveniently available; otherwise, he uses subsoil.

PRUNING AND TRAINING

THE YOUNG TREE

When obtained from the nursery, a 1-year-old peach tree usually is 3 to 7 feet tall and has few lateral branches large enough to be used as scaffold, or framework, branches. After the tree is set out, its lateral shoots are cut back to short stubs having 1 or 2 buds each (fig. 4, *A*). This brings the top into balance with the root system and

FIGURE 4.—*A*, Pruning a young peach tree; *B*, new growth starting on young peach tree pruned to 38 inches in height and to 2 to 3 inches in length of limbs just after it was set out.

forces the tree to develop stronger shoots, some of which will be selected as scaffold branches.

Spring-planted trees are cut back immediately after they are set out. On areas subject to severe winter cold, the cutting back of fall-planted trees should be postponed to late winter or early spring.

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The height to which a tree is headed back depends partly on its size and how well it is branched, partly on the grower's preference. Occasionally a 1-year-old nursery tree has well-developed laterals that can be headed back to 6 or 8 inches and spaced to form the head. If a low and spreading tree form is desired, the central stems of 1-year-old trees may be cut to a height of 18 to 24 inches. For convenience in cultivating around the trees and doing other necessary orchard work, a higher framework of branches is preferable. Where trees are headed back to a height of 18 to 20 inches, the scaffold branches usually arise close together on the trunk. If a tree has a stem about 36 inches long when it is planted, scaffold branches can be spaced farther apart on the trunk. This is a good reason for preferring nursery trees 4 feet or above in height, with diameters of approximately $\frac{9}{16}$ inch. Such trees are cut back to a height of 36 to 40 inches, and their lateral shoots are cut back so far that each has only a few buds (fig. 4). June buds may not be tall enough to need heading back. Any lateral branches that arise very low on a June-budded tree should be removed. This usually means pruning to a straight whip.

Pruning after the second growing season in the orchard is usually very light; tips of outside branches are cut back to keep the scaffold branches growing in an upward and outward direction, and any surplus branches that have arisen on the trunk are removed. If not all the scaffold branches were selected after the first season of growth

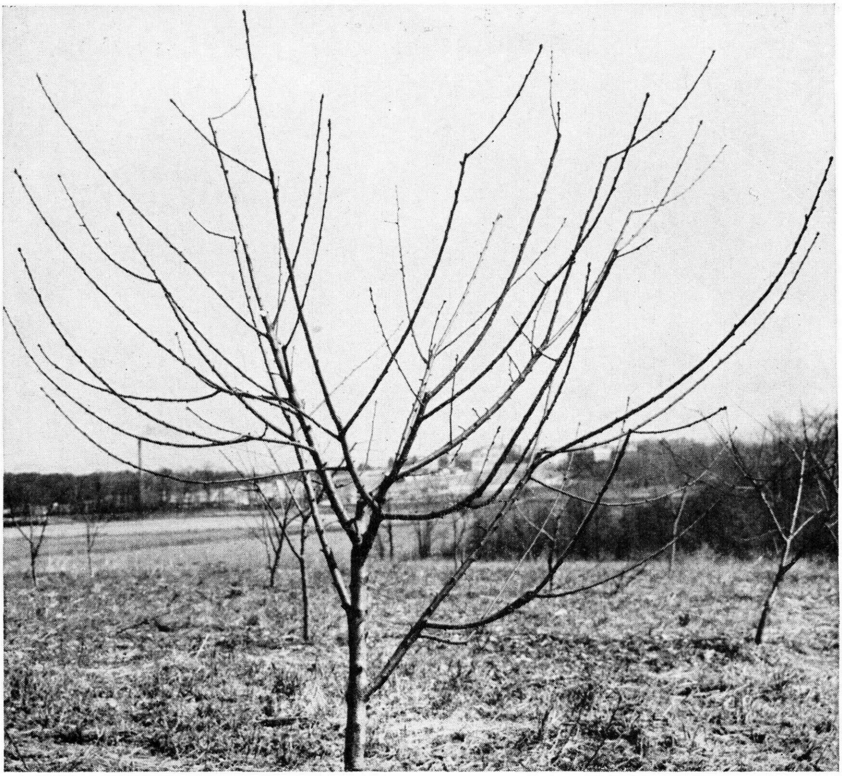

FIGURE 5.—A well-trained peach tree just pruned after 2 years in the orchard.

in the orchard, others should be selected after the second season. During the third and the fourth year only correctional pruning should be done, removing any branches that interfere with proper development of the main scaffold branches (fig. 5). Some of the small shoots on the inside of the tree should be left, for the first fruits are produced on such shoots. Treatment during the first 3 or 4 years is directed chiefly toward developing the framework of the young tree. Trees of some varieties may require little correctional pruning. Others, which naturally grow upright instead of spreading out, may need more cutting near the ends of the branches, to cause them to spread and keep them growing outward. Where it is necessary to head back a scaffold branch, in order to change its direction, the cut should always be made to an outside lateral branch growing away from the center of the tree. A 4- to 5-year-old tree that has been pruned in this way is open and has a good growth of fruiting wood throughout (fig. 6).

FIGURE 6.—A well-grown 5-year-old peach tree just after light pruning.

From the fifth through the eighth year the pruning is still largely correctional in nature—removing surplus branches growing from the scaffold limbs and heading back to outside laterals.

THE BEARING TREE

Bearing peach trees are pruned more severely than apple, pear, or plum trees of the same age. As with these fruits, however, severe pruning of young trees delays the time the trees come into heavy production. The fruit buds of the peach are borne on 1-year shoots, and annual pruning is necessary for trees on most soils to insure adequate shoot growth (fig. 7).

FIGURE 7.—The thick, matted condition of the crown of this 14-year-old Elberta tree resulted from a 1-year failure to prune. Because of it, the tree cannot produce fruits of normal size and cannot be sprayed satisfactorily.

If corrective pruning of a thinning-out nature is practiced, without any severe heading back, trees 4 or 5 years old should have a good spread of symmetrically developed scaffold branches (fig. 6). If this type of pruning is continued, after 4 or 5 years more the upper parts of the scaffold branches have a good platform of secondary branches 3 and 4 years old on which shoots can be cut back and thinned out in order that new shoots may be produced throughout the tree.

To maintain satisfactory growth of terminal shoots about 12 inches long on trees 10 to 15 years old, it may be necessary to do heavier heading back and thinning out than on younger trees (fig. 8). How much heading back is needed depends, of course, on how much new wood the orchard is producing. Trees of this age are pruned with about the same severity regardless of what type of training has been practiced in shaping them. In some 10- to 15-year-old trees there are scattered branches that grow very slowly and do not produce many peaches. Renewing these branches and shortening some of the terminals will increase the total of new, fruit-bearing wood through the trees. Frequently trees of this age group must be pruned more and more severely to produce desirable shoot growth. It may be necessary to cut back into older wood, removing entire branches 3 or 4 years of age. The pruning method should still be one of thinning out branches rather than a general heading back.

As tree growth slows down, say at an age of 15 to 18 years, even more severe pruning may be required to produce satisfactory fruiting wood.

In the warm latitudes of the Southern States, pruning can be done with safety any time between leaf fall and the start of growth in the spring; preferably, it is done in late fall or early winter.

In regions where peach crops are frequently lost by winterkilling of buds and where winter cold sometimes injures the wood, it is probably safest to prune in the spring when there is no longer any likelihood

FIGURE 8.—A 15-year-old Elberta peach tree (*A*) before and (*B*) after pruning.

of injury from cold. In small orchards, as a rule, the pruning needed can be done conveniently just before growth starts; in large orchards, it must usually be begun earlier. Apparently little harm to the trees results from pruning as late as full bloom. Pruning peach trees after full bloom and especially after their leaves and shoots make considerable growth prevents the trees from growing to their normal size or producing full yields of fruit. Vigorous trees with good reserves in the buds and branches show less harmful effect of late pruning than weaker trees.

There are good reasons, however, for sometimes delaying pruning until growth has started. Where wood injury has resulted from winter cold, pruning should be delayed until growth starts and the extent of the injury can be determined. Early and heavy heading back, or dehorning, of winter-injured trees may result in needless death of some of them. After growth has started the dead limbs can be pruned out without any serious consequences, while the limbs with live tissue and growing points are pruned only lightly. Heavy pruning of live branches of trees that have suffered wood injury by cold usually has less beneficial effect than use of readily available nitrogen in encouraging regeneration and growth of new tissue and thus developing good leaf systems on the trees.

Delaying pruning has its advantages also in years when there has been winterkilling of blossom buds only, because the percentage of live buds can be determined more accurately after the buds have swollen. Pruning can then be adjusted to the bud set. If pruning is delayed until near blossoming time and it is found that few buds or none have been winterkilled, the pruning can be heavier, reducing the number of blossoms and consequently the amount of fruit thinning to be done later on. Pruning and fruit thinning go hand in hand.

SOIL MANAGEMENT

Good management of the soil in which peach trees grow does as much as pruning toward keeping the trees vigorous. As has been mentioned already, a deep, well-drained soil of medium texture is highly desirable for peach growing. On nearly level orchard sites having soils of this kind and having adequate air drainage, control of soil erosion is not difficult. Management of the soil on more rolling

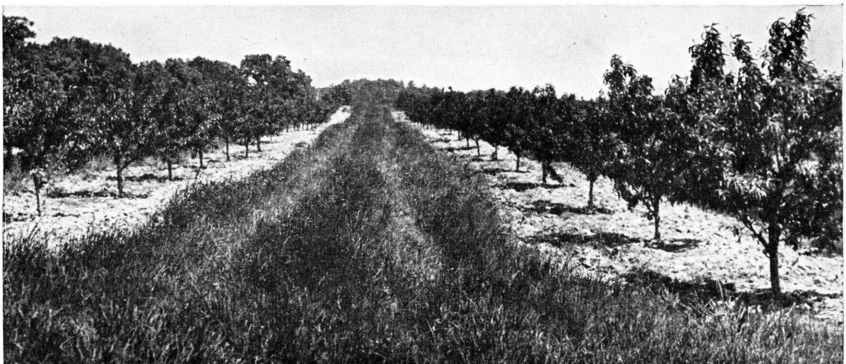

FIGURE 9.—Sod strips across the slope in this young peach orchard protect the soil from erosion.

sites requires careful attention. Except in the mild climates of the Southeast and where lakes give protection from unfavorable temperatures, peaches are planted on rolling to hilly sites in order to obtain good air drainage. On these upland sites the soil is frequently not more than 3 to 5 feet deep. It has long been customary to stir the soil of peach orchards early in the season, to make nutrients available to the trees. This cultivation improves moisture conditions by killing weeds and other plants that would have competed with the trees for moisture. A ground cover of growing plants on an orchard site, however, may serve the very important purposes of supplying organic matter to the soil and preventing loss of topsoil by erosion (figs. 9, 10, and 11). Tillage practices on any orchard site affect the soil and

FIGURE 10.—Here soybeans are being grown on strips, across the slope, between rows of young peach trees.

FIGURE 11.—Rye cover crop in peach orchard ready for spring disking.

moisture conservation and the organic-matter content and fertility of the soil.

IN THE YOUNG ORCHARD

During the first year after peach trees are planted, the orchard soil should be tended carefully to encourage adequate root and top growth. The soil around the trunks should be hoed two or three times during the growing season to keep down weeds, prevent soil baking, and provide for water penetration. In the larger orchards the soil should be cultivated along each side of each row of trees to a distance of at least 5 feet (fig. 9). It is not necessary to cultivate all the space in the tree middles. An annual or biennial cover crop may be grown on the cultivated strips (fig. 10) and turned under for the purpose of building up the soil. On sites that are low in soil organic matter and subject to water runoff and soil loss, cover crops are very desirable in the young orchard because they check soil erosion and because incorporation of cover-crop residues makes the soil more porous. Cover crops should not seriously hinder growth of the young trees by competition if they are confined to areas beyond the spread of the tree branches.

In orchards on level ground, it is often desirable to grow an intercrop during the first 2 or 3 years. The trees are benefited by the cultivation given such a crop and by the fertilizer applied to it. The intercrop should be planted across the slope, so that water collecting in and following the furrows made by tillage tools will not run off rapidly and carry away topsoil. In the second and third years less space should be allotted to an intercrop than in the first. Unless the trees are planted at least 25 feet apart in both directions, it is not advisable to plant an intercrop after the third year.

IN THE BEARING ORCHARD

No tree fruit is affected more by lack of available soil moisture and available nitrogen than is the peach. Peach trees root extensively, and after about 5 years the roots of trees planted 20 feet apart may meet. A cover crop competes with the trees for soil moisture and nutrients. The greatest amount of plant growth from a cover crop can be obtained during early and mid summer. This, it should be remembered, is also the time when most peach tree and fruit growth takes place. Cultivation results in breakdown of soil organic matter and thus in release of nutrients within it. The release of available nitrogen by cultivation often results in as much stimulation of the trees as does an application of fertilizer. Before inexpensive nitrogenous fertilizers became available cultivation was valuable for this purpose. Now, however, it is usually preferable to add nitrogen from the bag and keep the organic matter on or in the soil as long as possible. Only if we do this can we expect soil organic matter to be of the most value for its principal services—controlling erosion, maintaining soil porosity, and improving the general physical structure of the soil. Peach orchards are cultivated less now than they were 15 years ago, and that change is surely justified.

A cover crop that is seeded in late summer and grows during the fall or winter is best for the peach orchard, because it does not compete with the trees at the seasons when they require the greatest quantities of moisture and nutrients. Perhaps the most commonly used cover crops

for fall and winter are rye (fig. 11) and mixtures of rye and vetch. Rye begins growing early in the spring, and if used in an orchard it should be disked roughly onto the ground before it begins to compete seriously with the trees. Sometimes crops that winterkill, such as spring oats and millet, are grown during late summer and into the fall, or weeds are allowed to develop during that period. The crops or weeds are allowed to remain on the surface over winter and are disked down in early spring.

Sometimes much of the value of a cover crop is destroyed by too thorough disking. From the standpoint of water penetration and soil erosion, there is considerable evidence that as much as possible of the cover-crop material should be left on the soil surface. Rough disking, leaving much of the plant material uncovered, may give the appearance of a job not well done, but there is much justification for the practice.

On some sites and soils summer cover crops such as soybeans, cowpeas, and crotalaria should be grown in addition to a fall or winter crop. If danger of soil erosion is fairly serious, it may be advisable to grow a summer soil-protective crop even though it will compete with the trees and perhaps reduce the fruit crop. Some of the summer cover crops, such as late varieties of crotalaria and buckwheat, make most of their growth after the medium-early peach varieties are harvested.

Cover crops should be fertilized in accordance with the best local practice. Often a "complete" fertilizer is applied when a cover crop is planted.

Although legumes have often been recommended as orchard cover crops because of the part they play in natural addition of nitrogen to the soil, at the present cost of a bag of high-nitrogen fertilizer the growing of legumes is a far too expensive method of adding nitrogen to the soil of the peach orchard.

The permanent-sod system of soil management for the peach orchard is sometimes worth considering. Several experiments and many observations, however, indicate that it should nearly always be avoided. It appears that except in a few regions a sod over the entire orchard area often materially reduces the growth of trees and fruit. Where abundant water is available, either as rain or from an extraordinarily deep soil, a permanent cover is sometimes satisfactory. This is not the case in most parts of the Eastern and Southern States. The sod's use of soil nutrients is less serious than its use of water, since nutrients may be added as fertilizer. A sod-covered orchard area requires about three times as much nitrogen as one under cultivation, because so much is used by the sod. A mulch helps to conserve moisture in the sodded peach orchard, but we should remember that peach trees root extensively and the sod may compete for moisture with the tree roots even 12 to 15 feet away from the tree trunk. Some peach growers use a sod cover but disk the sod well every few years. Others use sod strips, across the slope, between wide cultivated peach rows. The sod strips control erosion, and the cultivation reduces plant competition with the trees. The sodded strips are useful also for moving sprayers and harvesting equipment, especially during wet weather. Orchard sod should be fertilized and mowed occasionally.

In soil-management studies carried on at the Plant Industry Station over a period of 12 years, cultivation of peach-orchard soil during the

summer showed some advantage over use of a summer cover crop. Annual cover crops showed considerable advantage over a semipermanent sod of sweetclover or lespedeza. Soil moisture seemed to be the principal limiting factor. In both comparisons, even mature trees were affected.

Some management system between clean cultivation and continuous sod can usually be worked out. Shallow disking two or three times a year commonly proves satisfactory. For best results, the system to be used for each orchard should be considered as an individual problem.

Soil and moisture conservation in the peach orchard is very important. Often contour planting is necessary. Sometimes a lay-out of terraces is needed, in addition. Much depends on the soil type, the amount and distribution of rainfall, and the percentage slope of the land. Soil and moisture losses are still too easily overlooked, and it is wise to take a chance of sometimes reducing the peach growth for the sake of soil conservation.

FERTILIZERS

Nitrogen remains the chief fertilizer element needed by peach orchards on most soils. Potassium is perhaps the element next most likely to get response. The elements necessary, and the rates at which they should be applied, vary widely according to soil type and other factors. Nitrogen can satisfactorily be added to the soil by applying ammonium nitrate, sodium nitrate, or ammonium sulfate, in either the fall or early spring. Rather small amounts of ammonium nitrate are sufficient, because of its high nitrogen content. Adding large amounts of nitrogen may, of course, reduce fruit color and delay ripening, particularly if it is done late in the season. With certain highly colored varieties, such as Redhaven, Dixigem, and Halehaven, a reduction in color is usually not serious. New varieties are being developed that color well even under high-nitrogen conditions. Some growers take advantage of the delay in fruit ripening caused by high nitrogen to extend the ripening season. Color reduction can be serious, however, in such varieties as Elberta and Belle.

All the chemicals just mentioned are caustic, poisonous, and inflammable. They should be kept dry and handled with care to prevent fire or explosion.

Fertilizer treatments, by maintaining the vigor of peach trees, make them less liable to winter injury.

THINNING THE FRUIT

Fruit thinning is definitely necessary to production of high-quality peaches, especially in years of heavy crops. The extent to which the fruit is thinned depends somewhat on the size of the mature fruit of the variety. In general, the smaller the normal size of the fruit at maturity, the wider the spacing to which the fruit should be thinned on the twigs. The correct thinning distance depends partly on the leaf area per fruit and the general vigor of the tree. It takes about 40 healthy green leaves of average size to produce a peach of good size and quality. Thinning should usually leave only one peach to every 6 or 8 inches of twig. Although this may seem to be drastic and expensive treatment, it must be remembered that small peaches are often very hard to sell. Also, thinning lessens the labor of har-

vesting the crop and the danger that limbs will break under the weight of fruit.

With the very early and early ripening peach varieties that tend to set a heavy load of fruit, reduction in the number of fruits well before the June drop greatly increases fruit size. These early ripening varieties have a much shorter period of fruit development than Elberta and later-ripening varieties. Varieties that particularly benefit from early thinning include Mayflower, Erly-Red-Fre, Redhaven, Dixigem, Cumberland, Golden Jubilee, and Triogem. With these varieties early thinning of fruit increases not only fruit size but also quantity of young-shoot growth and leaf size.

For many early ripening varieties, the final size of the fruits may not be greatly increased by thinning if the thinning is delayed much after the pits begin to harden. This is especially true if dry weather prevails during the early part of the growing season and at the time of harvest. The grower has to calculate whether the greater value of the larger fruits will justify the expense of early thinning.

With midseason and later varieties, the usual practice is to wait until after the first drop and then remove many of the small and imperfect fruits. Experiments with Elberta have shown that if the set is only moderate and the drop in June is fairly heavy, thinning done as quickly after that as possible usually results in fruits of good size and color. If thinning is delayed until well along in the pit-hardening period, it still has a beneficial effect on the final size of fruit. Even if thinning is done in the period of final swell it increases fruit size. When Elberta is bearing a large crop, it seems desirable to thin just as soon after the first drop as possible. If thinning is done quickly near the end of the first growth phase (before pit hardening), the result seems almost as satisfactory with Elberta as that of earlier thinning; and the cost is much less then, because it is easy to see which peaches will drop anyway and need not be removed.

How many peaches should be removed from a tree in thinning depends chiefly upon the size of the tree and its bearing capacity. If a tree cannot bear more than 1 to 2 bushels, only enough of the peaches that can develop to desirable size—such as a diameter of 2¼ to 2½ inches—should be left to make up this quantity. When a tree has a uniformly heavy set of fruit it is possible to thin to a fixed spacing such as 6 to 8 inches along the twig. In most cases it is best to thin not according to a fixed spacing but according to leaf area, tree vigor, and bearing capacity. After a spring freeze, sometimes the only blossoms left alive are those at the bases of terminal shoots. In such a case the fruits are not thinned, even where they touch each other, because the leaf area is sufficient for all.

Where labor costs are high, a peach grower may choose to reduce the number of peaches that will be produced on his trees by pruning off a large number of shoots either before or at blossomtime. In localities where spring frosts are likely to occur, some of the detailed pruning may well be postponed until blossoming time, when crop prospects are more certain.

Recently, because of high labor costs, there has been a trend toward rapid mechanical methods of thinning peaches. Some of the larger growers now use poles 4 to 8 feet long or longer, usually with about 12 inches of hard-rubber hose over one end. With such a pole the excess fruits are removed by tapping the branch or twig first at right

angles and then lengthwise. Wire or brush brooms are sometimes used to thin peach blossoms, especially those of early ripening varieties. Chemical sprays, also, have been used for thinning the blossoms. Elgetol is one of the sprays that have given the most satisfaction, although its results have not always been the same. If Elgetol is to be used, the strength suggested is 1 pint per 100 gallons of water and the spraying should be done at full bloom. Of course, blossoms should not be thinned by any method where it is likely that some of them will be killed by frost. The most experienced growers prefer to do only part of a necessary thinning by any of these rapid methods and then follow up with hand thinning.

LOW-TEMPERATURE INJURY

Low-temperature injury is one of the greatest problems of peach growers, both in the North and in the South. Almost every winter, serious injury of peach trees takes place in one or more sections of the country. Often winter injury is not recognized as such, for it can occur when temperatures have not been unusually low. For example, rapid drops in winter temperature from about 70° F. during the day to about 18° at night have caused severe damage to the wood of peach trees in southern areas. In northern areas the damage is likely to occur only at much lower temperatures and dormant flower buds are affected before the wood is. A deep and rapid drop to temperatures below −15° often injures twigs and trunks (fig. 12) as well as buds. Sometimes, in peach orchards having no ground cover, prolonged low temperatures even damage the tree roots.

In both northern and southern peach-producing localities, winter injury seems to be least among moderately vigorous trees that grew well during the previous season and have not been weakened by poor drainage, loss of leaves, borers, nematodes, or other such factors.

INJURY TO BUDS

The most common type of winter injury to peaches in the Northern States is killing of dormant flower buds. More rarely, leaf buds are injured. There is no definite upper limit of temperatures at which dormant flower buds are destroyed. Much depends on the tree growth during the previous growing season, age and vigor of tree, variety, stage of flower-bud development, rapidity of temperature drop, its time of occurrence, and duration of the low temperature. During midwinter the danger point for Elberta is about −10° F. A rapid drop in temperature after a warm period can lead to bud killing at temperatures much higher than that. Conversely, buds have sometimes survived temperatures below −20° in midwinter when the drop was very slow and followed a period of relatively cold weather.

Differences in flower-bud hardiness between peach varieties sometimes mean the difference between a good peach crop and none. Elberta and J. H. Hale are two of the more tender varieties. Rochester, Hill Chili, Greensboro, Carman, and Erly-Red-Fre are among the more hardy ones. Halehaven, Golden Jubilee, and Redhaven may be classed as fairly hardy. Some varieties such as Halehaven, Redhaven, and Cumberland often bear fair to good crops after large percentages of the buds have been killed, because they characteristically have large numbers of buds per foot of twig length.

Some other varieties have so few buds that killing of even a small percentage may make a good crop impossible.

The one definite relation between fertilizer treatment and bud killing seems to be that represented by the greater killing on trees of very weak growth. Even where there is a marked difference in fertilizing and in associated appearance of the trees, little or no difference is usually found in bud survival during midwinter.

In many parts of the country, especially in the Central and Southern States, damage often results from low temperatures during or after bloom. As flower buds develop in the spring, they quickly become more and more tender. Just before they open, they will survive temperatures of about 20° to 23° F. The lowest temperature the flowers will withstand at full bloom is about 26°. At 10 days to 2 weeks after bloom they will withstand only about 28°. Buds and flowers will survive temperatures slightly lower than those just given if the drop is very slow and the minimum temperature continues only a very short time.

Unless accurate thermometers are used in the orchards themselves, it is easy to be mistaken about temperatures there. Early-spring

FIGURE 12.—A sudden drop in winter temperature caused the break in this tree trunk.

temperatures, especially on hillsides, cannot be assumed to be uniform even at points only 50 feet apart. The higher part of a sloping site is usually much warmer than the lower part, since cold air drains downward. A 50-foot difference in elevation on a hillside may mean a difference of as much as 5° F. in minimum temperature on a still night.

INJURY TO TWIGS, BRANCHES, AND TRUNKS

Even in some of the most southern peach areas and during some of the mildest winters, wood killing is often serious. It is caused by rapid drop in temperature, not necessarily to a very low point, and by immaturity of wood. Immaturity of wood often results from new growth in late summer or early fall brought about by high soil fertility, high rainfall, high soil nitrogen content, recent heavy pruning, or other factors. Evidently certain processes necessary to the hardening of the tree are carried on only if the trees are exposed to low temperatures gradually. In contrast with winterkilling caused by this immaturity, characteristic of vigorous trees, is winter injury to weak trees. Trees that have grown poorly for any reason are especially subject to winter injury to trunks and branches. Poor soil drainage, nematode injury to roots, low soil fertility, insect damage, and disease are common reasons for weak growth and therefore for winter injury. No definite temperature at which wood injury will likely occur can be given. Serious trunk damage has resulted from 20° F. in the more southern peach areas, whereas none has resulted from −20° in northern areas during certain years. In both northern and southern peach-growing regions, the least low-temperature damage seems to occur in trees of moderate vigor and where there are no sudden changes in temperature.

Even though wood may seem to have been damaged by winter cold, much of it may survive if the trees are not pruned too early or too severely and if quickly available nitrogen is applied somewhat more heavily than usual. If bark on the trunk is found to be loose after a severe drop in temperature, it should be tacked in place immediately. This sometimes aids in preventing drying out of the bark and wood and may hasten healing. When there has been severe damage to large branches or trunks, the injured parts should be painted with a standard tree paint, white lead and raw linseed oil, or a liquid (brush) grafting wax.

INJURY TO ROOTS

Injury to peach roots from cold is too often overlooked or disregarded. More injury than is commonly realized occurs in this part of the tree. Winter injury to roots is usually most severe in light, sandy soils and after prolonged cold. It is much worse where there is no snow or other covering on the ground. Cover crops are valuable in preventing this type of injury. In addition to directly insulating the roots from cold, cover crops tend to hold protective snow in place. After severe killing of roots, tops should be given a moderately heavy pruning.

In some instances freezing of orchard soil, although it does not kill tree roots, retards their absorption of water during the winter. Trees grown in light, shallow soils in more northern States are, of course, those most likely to be injured by this condition.

HANDLING, TRANSPORTING, AND STORING FRUIT [1]

The peach grower's choice of a time for picking his crop depends largely on how he intends to market it. If peaches are to be trucked to nearby markets, they may be allowed to become nearly ripe on the trees. For long-distance shipment they must be picked when still firm—at what is called the "shipping ripe" stage. Fruit that is to be cooled before shipment or shipped in fan cars can be left on the trees till somewhat more mature than if it were to be shipped under standard refrigeration in ordinary cars and without precooling. Because peaches mature unevenly it is usually advisable to make several pickings, beginning with the largest, best-colored fruit. For freestone varieties, standards of maturity have been based on the ease with which the flesh separates from the pit. Probably a more reliable basis for rating maturity is flesh firmness as determined by using a pressure tester (fig. 13). Elberta peaches testing 12 to 14 pounds

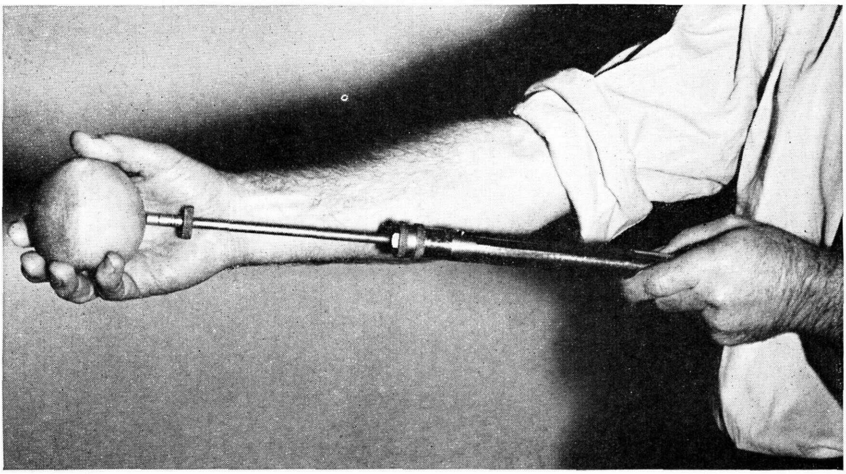

FIGURE 13.—Pressure tester used to determine maturity of peaches.

when a $\frac{5}{16}$-inch-diameter plunger is applied to the pared cheeks will hold up in refrigerated shipment for several days and ripen with satisfactory dessert quality. Somewhat greater firmness may be required of peaches intended for long-distance shipment; for nearby marketing, less firmness may be desirable. About the same range in pressure test is satisfactory for many varieties other than Elberta.

Drop-bottom picking bags are now used for peaches to a considerable extent. Greater protection from bruising is given by padded drop-bottom picking buckets (fig. 14). It is very important that pickers exercise great care in handling peaches to avoid bruising the fruit and breaking the skin. They must be careful not to drop fruit, either when placing it in picking buckets or bags or when transferring it to field crates or baskets. Field crates give much greater protection from bruising or cutting than baskets and can be stacked much more conveniently. Picked fruit should be left in the shade of a tree until it can be hauled to the packing house.

[1] This section was prepared by M. H. Haller.

FIGURE 14.—Harvesting peaches in a picking bucket designed to prevent bruising. This bucket has padding around the upper edge and in the bottom. Cords holding the bottom in position are fastened with hooks at the sides of the bucket.

Peaches are usually packed in tub bushel baskets. Some are packed in half-bushel baskets. The bushel basket makes a rather economical package, but has some undesirable features for use with such tender and perishable fruit as the peach; fruits in the bottom—especially if they are ripe and soft—are likely to be bruised and mashed by the weight of those on top of them, and the basket is not rigid and does not stack well. If baskets are used they should be of the ventilated tub type, with vented liners. Peach lugs of 16-pound capacity, such as are used in many sections of the West where the fruit is wrapped and place-packed, give better protection. Wire-bound (Spartan)

crates and cell-type cartons have been tested as peach containers with some success.[2]

At the high outdoor temperatures that prevail during the peach-marketing season, picked fruit ripens very rapidly and also is subject to very rapid decay. Peaches picked at the shipping stage of maturity become eating ripe in 4 to 8 days at temperatures of 80° to 70° F. Ripening proceeds about half as fast at 60° as in the 80°-to-70° range, and about half as fast at 50° as at 60°. At 60° and above, peaches ripen with good aroma and flavor for their variety; if held at 50° until ripe they have undesirable flavor. At 40° ripening proceeds about half as fast as at 50° and the peaches usually break down internally before they become fully ripe. Temperatures of 36° and 32° hold both ripening and decay practically to a standstill. After being exposed for not more than 1 week to 50° or lower temperature the fruit will ripen normally at room temperatures. After exposure for 10 days or longer to temperatures in the 50°-to-36° range, the fruit is likely to break down internally or to become mealy or off-flavored if ripened at room temperatures. Peaches can be held somewhat longer at 32° than at 36° to 50° without losing the capacity to ripen normally when exposed to ripening temperatures.

The freezing temperature of peaches averages about 30° F. To allow for cold spots in the storage room and otherwise provide a margin of safety, peaches should not be held in a room where a thermometer registers any air temperature lower than 31° to 32°.

In most peach-producing regions the development of decay in the fruit during marketing is a very serious problem, particularly in seasons when rainfall and humidity are high at or near the harvest period. Most of the decay in peaches is of the two kinds called brown rot and rhizopus rot (fig. 15), each of which is caused by a fungus. Brown rot

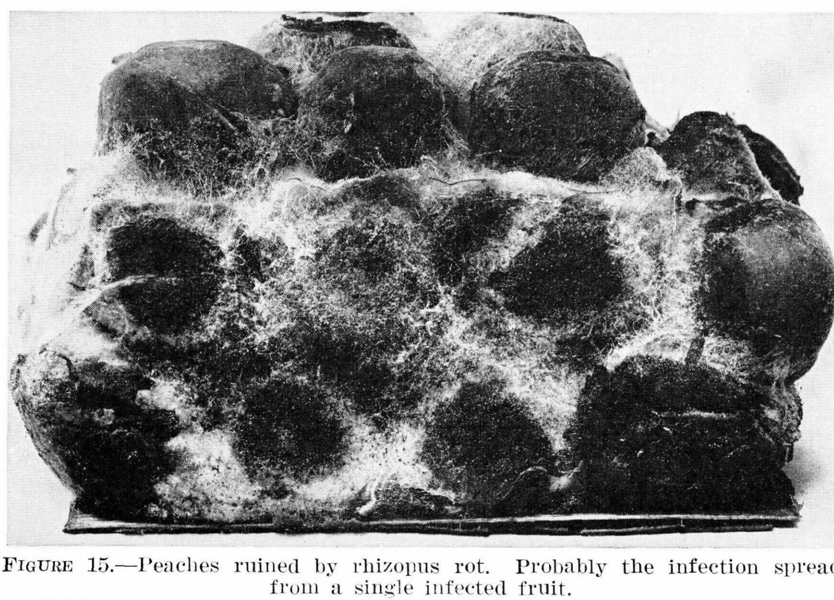

FIGURE 15.—Peaches ruined by rhizopus rot. Probably the infection spread from a single infected fruit.

[2] For detailed instructions on grading and packing peaches, see Farmers' Bulletin 1702, Preparing Peaches for Market.

infection occurs chiefly in the orchard, and how much brown rot occurs in fruit after harvest depends largely on how well the rot has been controlled in the orchard by spraying and sanitary measures. At high temperatures both the brown rot fungus and the rhizopus fungus develop and spread very fast. Both can be checked in great measure by cooling the fruit as soon as possible after harvest and keeping it at low temperatures throughout the marketing period. Ripening, also, is retarded by the low temperatures, however; and at some point during marketing or after the peaches reach the consumer they must be exposed to temperatures high enough to ripen them. Under such temperatures decay develops; so that although low temperatures during transit and marketing may make it possible to market the fruit before decay becomes serious, they do not generally reduce the amount of decay that develops in the fruit by the time it is ripe enough to use.

Low temperatures greatly retard the development of heat by respiration of the fruit. At 70° F. a carload of peaches gives off enough heat to melt about 1,000 pounds of ice per day, but at 32° it generates only enough heat to melt about 100 pounds per day.

Because of the decay hazard and of the influence of temperature on ripening, peaches should be moved to market rapidly and under the coolest conditions that can be maintained. If they can be delivered to market the morning after they are picked, an unrefrigerated truck usually serves the purpose. Trucks should not be used for longer shipment unless they are effectively refrigerated. In the refrigerator cars ordinarily used for rail shipment, 2 to 3 days may be required to cool the fruit to a temperature of 50° F. in the top part of a load and to one of 40° in the bottom part. In cars equipped with air-circulating fans, the desired low temperatures are reached much more quickly and the top part of a load is kept very nearly as cool as the bottom part. Thus in fan cars the fruit ripens appreciably less and ripens more uniformly than in ordinary cars. More rapid cooling can be obtained also by precooling the loads. This is done with portable refrigerating units or by circulating the air through the bunker ice.

In precooling, air may be circulated by means of fans permanently installed in cars or propeller-type fans installed temporarily in the top bunker openings. Space around a fan installed in a bunker opening is closed by means of baffles, as shown in figure 16. In either method, the fans reverse the normal direction of air movement and cool the top part of the load more than the bottom part. By these methods it is possible to lower the average temperature of a load of peaches about 20° to 25° F. in 5 to 6 hours. Further precooling requires replenishing the ice in the bunkers and continuing to operate the fans.

Precooling can be practiced to advantage only if facilities are available for replenishing the ice promptly after precooling in order to maintain during transit the low temperatures established by precooling.

Peaches are sometimes stored for short periods to extend the marketing season and the commercial canning season. Fruit that is to be stored should be cooled promptly after picking to a temperature of 31° to 32° F. Even under the most favorable conditions, peaches cannot usually be stored longer than 2 to 3 weeks. Loss of the capacity of stored peaches to ripen with good dessert quality and without breakdown is not indicated by their appearance or physical condi-

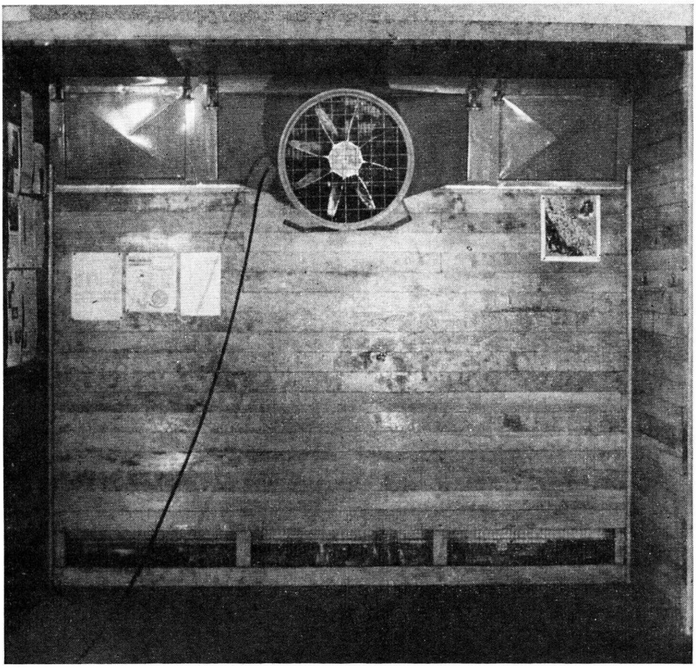

FIGURE 16.—Precooling fan in position in end of refrigerator car.

tion; the proper time for bringing the fruit out of storage and marketing it must be determined on the basis of experience with the variety. The storage life of J. H. Hale peaches cooled promptly to a temperature of 31° to 32° is 3 to 4 weeks, and that of Elberta, Rochester, and Golden Jubilee peaches similarly cooled is 2 to 3 weeks.

DISEASES CAUSED BY FUNGI AND BACTERIA [3]

The principal fungus and bacterial diseases of the peach east of the Rocky Mountains are brown rot, scab, and bacterial spot. These three widely distributed diseases frequently cause heavy losses to peach growers, shippers, and consumers alike. Other fungus and bacterial diseases of the peach in this region include leaf curl, rust, crown gall, powdery mildew, root rots of various types, and dieback.[4]

BROWN ROT

Brown rot, the common rot of the peach, starts as a tiny brown spot on green or ripening fruit, frequently at an insect puncture. The surface area affected enlarges rapidly, the rot penetrating deeply

[3] This section was prepared by J. C. Dunegan.

[4] The organisms causing diseases mentioned are as follows: Brown rot, *Monilinia fructicola* (Wint.) Honey; scab, *Cladosporium carpophilum* Thuem.; bacterial spot, *Xanthomonas pruni* (E. F. Sm.) Dows.; leaf curl, *Taphrina deformans* (Berk.) Tul.; rust, *Tranzschelia pruni-spinosae discolor* Dunegan; crown gall, *Agrobacterium tumefaciens* (E. F. Sm. & Towns.) Conn; powdery mildew, *Podosphaera oxyacanthae* (DC.) DBy.; root rots, *Armillaria mellea* Fr. and allied fungi. *Valsa leucostoma* Fr. and *Diaporthe eres* Nit. are commonly associated with dieback.

into the flesh of the peach. Finally the entire peach becomes diseased. After that, it may shrink to a hard brown mummy. Masses of spores are produced on the rotted surface (fig. 17). These spores, known as conidia, may be carried by insects, birds, wind, or splashing rain drops—or even by man—to nearby healthy peaches, which they then infect.

FIGURE 17.—Peaches covered with spores of the brown rot fungus. The infection spread to the twig from the blighted blossom still attached to it, and to the fruit from the twig.

If peach mummies are left on the tree the fungus may grow into the twigs and cause cankers, which may girdle and kill the twigs. In the South, mummies which remain hanging in the trees rarely carry the fungus through the winter; in the North, mummies left on the trees over winter often produce numerous fungus spores the following spring (fig. 18). These may be carried to peach blossoms and infect them, producing the phase of the disease known as blossom blight. It is very desirable that any mummies clinging to the trees be taken off and destroyed in the fall or winter. If mummies are allowed to

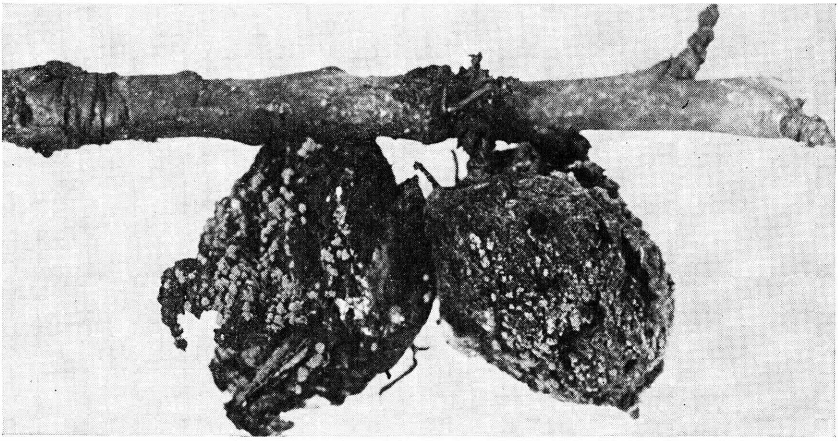

FIGURE 18.—Peach mummies producing spores (conidia) of the brown rot fungus.

accumulate under the trees and become partly buried there they frequently give rise the next spring to goblet-shaped fruiting bodies (fig. 19), known as apothecia, which shoot spores of another kind (ascospores) into the air. These spores, like the conidia, may infect blossoms.

Only occasionally does the brown rot fungus destroy enough blossoms in a peach orchard to thin the crop too much, but even a scattter-ing of blighted blossoms through the trees seriously threatens the crop's safety. The fungus kills the blossom and penetrates into the twig, killing twig tissues and producing a canker. Gum oozes from the twig canker and tends to cause the blighted blossom to adhere to

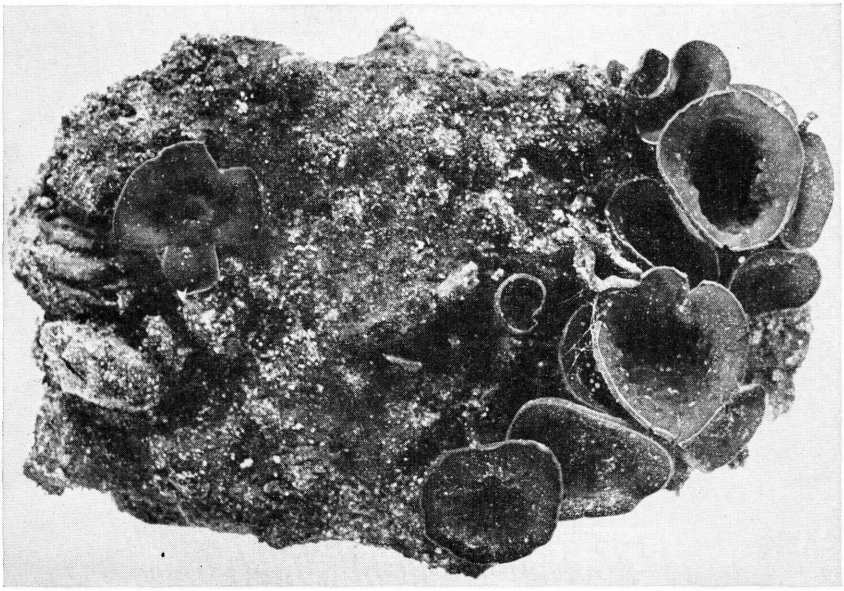

FIGURE 19.—Goblet-shaped fruiting bodies (apothecia) developing from partially buried peach mummy.

the twig (fig. 20). The blighted blossoms produce masses of conidia during the current growing season and, sometimes, even the following season, thus serving as a source of infection to the ripening fruit.

Control of brown rot involves sanitary measures such as removing rotted fruit from the trees; removing mummies from the ground; properly pruning trees so that they can be sprayed thoroughly; thinning the fruit, to reduce spread of the disease from infected peaches to healthy peaches in contact with them; controlling insects such as the plum curculio and the oriental fruit moth, which puncture fruits and thus give entrance to brown rot spores; and spraying or dusting the fruit at regular intervals during the season.

While many chemicals have been tested for control of brown rot, sulfur is still the one most widely recommended for this purpose. The materials, concentrations, and numbers of applications recommended vary among different localities. The grower should consult his State agricultural college for recommendations adapted to his locality. In general, it is advisable to use from 5 to 8 pounds of finely divided sul-

fur in each 100 gallons of water and to spray five times a season—(1) when most of the petals have dropped, (2) when three-fourths of the shucks have dropped, (3) 2 weeks later, (4) 2 to 3 weeks after the third application, and (5) 2 to 3 weeks after the fourth application.

A dust containing 80 percent sulfur, 5 percent arsenate of lead, and 15 percent hydrated lime may be used instead of a spray, at the times just mentioned.

FIGURE 20.—Gum oozing from brown rot twig canker.

A spray containing 6 pounds of sulfur per 100 gallons of water, applied at 3-day intervals during the blossom period, markedly reduces blossom blight. This reduction of centers of brown rot infection in the trees materially assists in controlling fruit rot at harvest time.

Sulfur is inflammable, and care should be taken in storing and handling it to prevent ignition. When it is mixed in water and used as a spray there is little danger, but when it is applied as a dust there is always considerable danger of ignition from static electricity. Motorized dusting equipment should have a chain or other flexible conductor attached to it and in contact with the ground to prevent charges of static electricity from accumulating. This is particularly important with equipment mounted on rubber tires. Adequate precautions should be taken to protect the operator from poison spray or dust.

SCAB

Scab, known also as black spot or freckles, is a fungus disease of peaches in which circular spots 1/16 to 1/8 inch in diameter appear on the fruit usually near the stem end (fig. 21). These spots are faintly greenish at first but soon become olive green to black, with well-defined

FIGURE 21.—Scab spots on peaches, showing the cracking which often develops when the spots are numerous.

margins. When numerous, the spots run together and form a large black scab-like area involving as much as half the surface of the peach. The scabby area frequently splits open, exposing the flesh, which may then be infected by spores of the brown rot fungus. Where the scab infections are numerous, the fruit is likely to be so stunted and misshapen that it cannot be used. The scab fungus attacks tender green shoots of the current season, producing small brown oval cankers frequently with purplish borders. These cankers are seldom more than 1/8 inch long, and they extend only slightly below the surface. They rarely cause any serious weakening of twigs, but in them the fungus may remain alive during the winter and produce spores the following spring, which may infect the new crop of fruit.

Scab can readily be controlled by applying sulfur as either a spray or a dust. The spray must be applied 2 weeks after the shucks have dropped from the peaches. For varieties maturing later than Elberta, a second application should be made 4 weeks later. At these times, scab spots have not appeared on the fruit and the grower is likely to consider that his crop is safe from the disease. This is a very serious mistake; infections take place early in the season, but the fungus grows so slowly that the spots do not become visible until from 40 to 60 days after infection. When the spots do appear, it is nearly always too late for spraying or dusting to do much good.

BACTERIAL SPOT

Bacterial spot, sometimes called bacteriosis, results from entrance of a certain kind of bacteria into uninjured tissues of leaves, fruit, and twigs. On leaves the first sign of the disease is development of purple or purplish-brown spots (fig. 22), which are generally angular in shape. The individual spots are rather small at first; but spots may run together. Eventually the affected tissues die and tear away from the healthy tissues, producing a shot-hole effect. When many leaves are affected, premature leaf fall often results. On the fruit the disease is first visible as a tiny watery-looking spot, slightly sunken. As the peach continues to grow, cracks and fissures of various sizes develop which mar the appearance of the fruit (fig. 22). The cracking around

the spots of dead tissue makes the fruit unmarketable and frequently leads to entrance of the brown rot fungus.

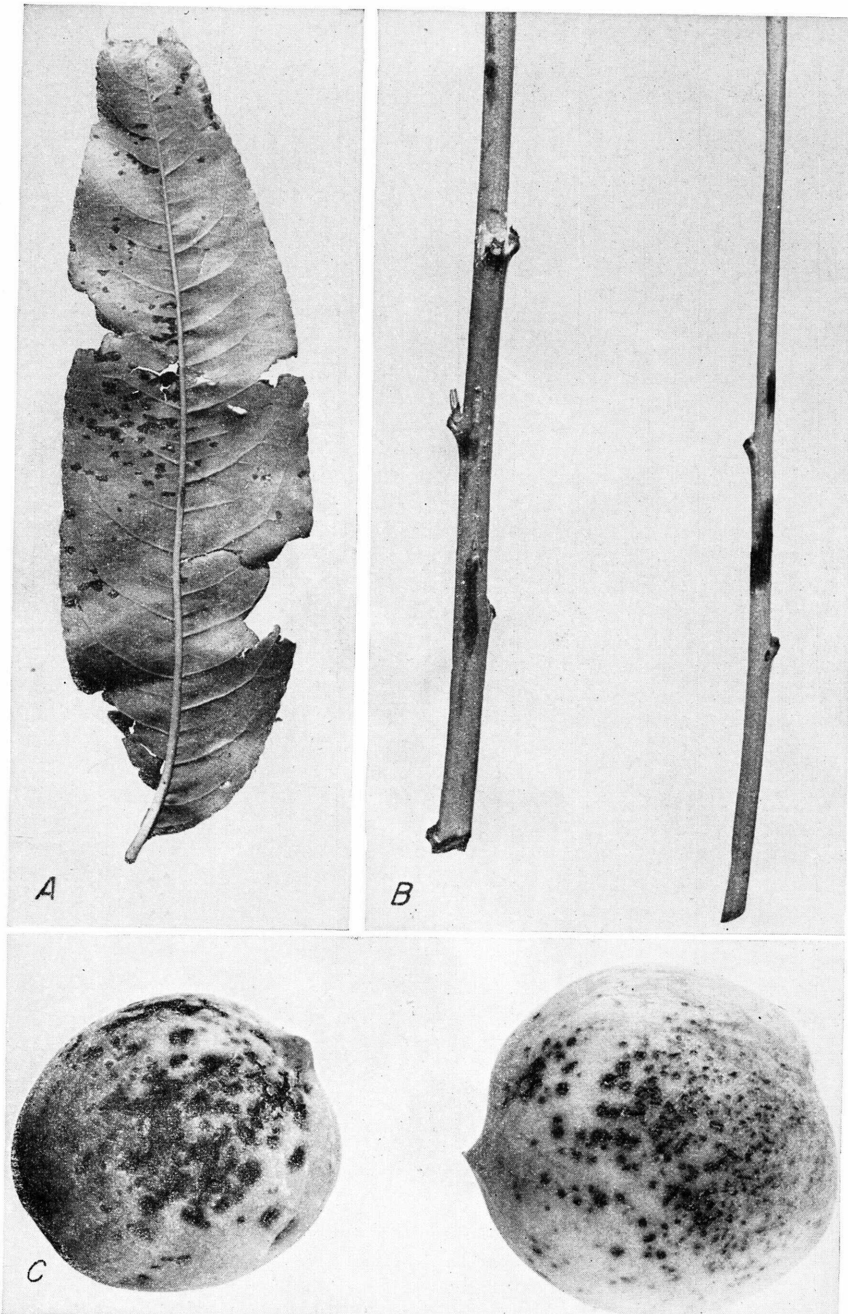

FIGURE 22.—Symptoms of bacterial spot (*A*) on peach leaf, (*B*) on young peach shoots, and (*C*) on mature J. H. Hale fruit.

Cankers are formed on the twigs at various times during the growing season. These cankers in themselves have little influence on the life of the tree, but some of them carry the bacteria over winter. The following spring, bacteria oozing from such cankers start another cycle of leaf, fruit, and twig infections.

Bacterial spot is present in practically all peach-growing sections of the Eastern States. It causes serious annual losses, chiefly where soils are light and rather low in fertility. Vigorous trees are less susceptible to the disease than trees in a state of neglect. Proper pruning, cultivation, and fertilizing and other good orchard-management practices are recommended as control measures; but these alone cannot be depended upon for control where bacterial spot infection is severe and especially where soil improvement is difficult. Efforts at control by removing sources of overwintering infections have not succeeded as yet. The disease can be held in check only by a series of five to seven spray applications at 2-week intervals, starting at petal fall. Many spray materials have been tested. The most satisfactory combination in use at the present time is the one called the zinc-lime spray, for which the following formula is recommended:

Zinc sulfate	8 pounds.
Hydrated lime	8 pounds.
Water	100 gallons.

Zinc sulfate ($ZnSO_4.7H_2O$), commonly called granular zinc sulfate or white vitriol, is easily obtained through wholesalers and jobbers. A so-called "anhydrous zinc sulfate" is sometimes found on the market. This product is not anhydrous (free from water) but contains less water than the granular zinc sulfate and is more easily handled because it is less lumpy. If the "anhydrous zinc sulfate" is stored in a dry place and kept well covered so that it cannot absorb water, 6 pounds of it may be considered to equal 8 pounds of the ordinary granular zinc sulfate. The hydrated lime should be fresh and of high quality. The grade known in the trade as "chemical" is especially recommended. If the quality of the lime is not definitely known more of it should be used, especially if arsenate of lead is to be included in the spray.

Care should be taken to store zinc sulfate in a dry place. There is some risk of heating and spontaneous ignition if it is allowed to absorb moisture.

The spray should be prepared as follows: Fill the tank nearly full of water. Start the engine to give agitation. Add the zinc sulfate. If the lumps have been well broken up it will dissolve in less than 5 minutes. Mix the lime with a small quantity of water to form a thin paste, and when the zinc sulfate has dissolved wash this paste through the strainer into the tank. Finish filling the tank, and agitate for 5 minutes or more before beginning to spray. By agitating, it is rather easy to keep the white precipitate from settling. Use at once.

The spray should cover all parts developing during the current season, including fruits, leaves, and twigs, to protect them from infection. In particular, it should cover the *under sides* of leaves. This will require at least five applications.

If arsenate of lead is used in combination with the zinc-lime spray, the zinc-lime decreases the risk of arsenic injury to foliage.

The zinc-lime spray must not be depended upon to control scab and

brown rot. Sulfur sprays, which are commonly used on peaches for the control of these diseases, may safely be applied to peach trees in mixture with the zinc-lime spray.

PEACH LEAF CURL

Peach leaf curl is due to a fungus which causes the early appearing peach leaves to become reddened, thickened, and distorted and later to turn brown and fall. The spores of the fungus live over winter in the buds, germinate in the spring, and infect the young leaves as they develop.

If only a small percentage of the leaves are affected, the set of fruit will not be materially reduced and the trees will come through without serious injury; but if the number of affected leaves is such as to cause heavy defoliation at or near blooming time, the disease may prevent fruit set and in the course of several years may cause the trees to become stunted.

Peach leaf curl can be controlled by a single application of lime-sulfur solution or bordeaux mixture made in the fall after the trees shed their leaves or during the winter when the temperature is above freezing and before the buds begin to swell.

Lime-sulfur solution may be used at the rate of 1 gallon in 15 gallons of water for control of leaf curl alone. If used at the rate of 1 gallon to 7 gallons of water, it will control San Jose scale as well as leaf curl.

A 6–6–100 or stronger bordeaux mixture may be used, and should be used if spraying with an oil emulsion is contemplated. The oil should be added after the bordeaux mixture is placed in the spray tank.

PEACH RUST

Peach rust is a leaf disease which is very prevalent in the southern peach districts toward the end of the growing season. Numerous spots, yellow on the upper surface and bearing masses of powdery brown spores on the lower surface, develop on the leaves. In some seasons rust infections become so numerous that they cause premature leaf fall and probably weaken the trees. At the present time no measures for the control of this disease are being practiced east of the Rocky Mountains.

CROWN GALL

Crown gall is a bacterial disease characterized by formation of swellings or galls on the trunks and roots of the trees. No nursery tree showing crown gall should be planted. Trees so affected cannot be expected to grow well or to live long, and if they are planted the bacteria are likely to spread to other trees. Removing the galls does not free a tree of infection, and little can be done to control the disease once it becomes established in an orchard. It is a matter of prime importance to plant only healthy nursery stock.

POWDERY MILDEW

Powdery mildew is seldom a serious problem in eastern commercial peach orchards. This disease distorts young shoots and leaves and checks their growth. White patches appear on the fruit, and eventually these patches become smooth, brown, and hairless. Frequently powdery mildew on peach is associated with powdery mildew on near-

by rosebushes. Where the disease requires any special application, sulfur should be used.

FUNGUS ROOT ROTS

Fungus root rots due to several organisms may at times cause the death of peach trees, particularly in plantings on newly cleared land. Once a tree is affected there is little hope of saving it. New types of soil fumigants now being tested may solve this problem. A grower who finds appreciable numbers of his trees affected with root rot should consult his State agricultural college.

DIEBACK

"Dieback" is a general name given to a number of little-understood conditions which result in the death of peach twigs and branches. Rough cankers, frequently centering around buds or wounds, appear on the branches. The cankers enlarge slowly, sometimes girdling the affected limbs or twigs. When this occurs during the growing season the leaves take on a yellowish color and then suddenly wilt and die. In a special form of this trouble called the constriction disease, numerous limbs are girdled by cankers early in the summer and groups of leaves scattered through the trees become conspicuously bleached and wilted. Several species of fungi are found in the cankers. It is generally believed that these fungi attack trees or parts of trees only after some such factor as frost, spray injury, or neglect has weakened them.

DISEASES CAUSED BY VIRUSES [5]

Virus diseases were first associated with peach culture in the nineteenth century. Stories of the devastation and losses resulting from epidemics of peach yellows in northeastern United States during the 1800's serve as reminders that virus diseases can be serious if they are left uncontrolled. Little peach, another virus disease, which is thought to be caused by a strain of the yellows virus, became serious in the same geographic area as yellows in the late 1800's and now causes more losses than yellows. In southeastern United States peach rosette and phony disease, both caused by viruses, have been common since the early 1900's and cause serious losses in peach. Within the past 30 years the following additional virus diseases affecting peach have appeared in northeastern United States: Red suture, X-disease, rosette mosaic, necrotic leaf spot, ring spot, and line pattern. Peach mosaic and asteroid spot are virus diseases which occur in southwestern United States as far east as eastern Texas, southern Oklahoma, and western Arkansas.

For the purpose of this discussion, a virus may be considered as an extremely small organism, too small to be seen through the ordinary compound microscope, which lives and multiplies as a parasite in living tissue. Virus diseases of plants are spread with juice or by infected propagation material and occasionally through seeds from infected plants. In nature, they are most commonly spread by insects. These insects suck juice from infected plants and lose some of it while feeding on healthy plants, thereby infecting them. None of the viruses affecting fruit trees are known to have been transmitted

[5] This section was prepared by L. C. Cochran.

mechanically from one tree to another with infected juice and only one, ring spot, has been found to be transmissible through seeds (it passes through some of the seeds of mazzard and mahaleb cherries). It is highly improbable that any of these viruses can be spread by cultivation procedures, such as pruning, spraying, thinning, or tillage. Spread into new areas is usually by infected nursery stock, and spread within orchards is both by insects and through use of infected propagation material.

PEACH YELLOWS

The diagnostic symptoms of peach yellows are premature ripening of fruit; inward rolling, pale green to yellow color, and drooping appearance of leaves; and development of small, clustered shoots with yellow leaves along the trunk and main branches of the tree (figs. 23, 24). Fruit on affected trees ripens a few days to 3 weeks earlier than normal, lacks sweetness, and is bitter in flavor. The peel on such fruit is commonly spotted with red and purple, and on normally red-colored varieties may be solid purple. Red streaks of different lengths extend from the seed toward the peel, and in red varieties the tissue around the seed is deep red. On young trees and vigorous older trees affected with peach yellows, buds formed in the summer fail to remain dormant, and put out small yellowish leaves the same season. In advanced cases, the ends of twigs and branches die and clusters of small shoots bearing small pale-green to yellow leaves grow from the trunk and main branches. These are known as wire shoots. Some varieties produce more of them than others. Affected trees usually die within 2 to 6 years.

Plums, both cultivated and wild, have commonly been found to carry the yellows virus, but most plum species are not injured by it and do not show any easily recognized symptoms. The disease is spread by the plum leafhopper (*Macropsis trimaculata*), which prefers to feed on plums and migrates from them to peaches.

Yellows-affected trees should be removed from the orchard as soon as the disease is recognized. If an infected tree is left standing in an orchard the disease spreads rapidly to neighboring trees. Some States have laws prohibiting sale of yellows-affected fruit and requiring that yellows-affected trees be destroyed. Care should be taken to obtain peach budwood from known yellows-free sources and to grow nursery stock apart from any natural hosts of the yellows virus. Plum trees considered as a source of material for budding or as rootstocks should be checked for yellows before they are used. In localities where the disease has become widespread, peaches should not be grown within 1 mile of plums. The yellows virus can be killed in peach budwood or nursery trees with heat, but there is no known method of curing orchard trees infected with it.

LITTLE PEACH

Some symptoms of the little peach disease sufficiently resemble those of yellows to suggest that little peach is caused by a strain of the yellows virus. Trees affected with little peach, like those with yellows, have a droopy appearance, and in late stages of the disease the leaves turn pale green to yellowish. Little peach is transmitted by the same insect as yellows, and the little peach virus is killed by heat at the same temperature that inactivates the yellows virus. Little peach differs

FIGURE 23.—The small willowy growth from main limbs of this tree is a symptom of peach yellows. Such growth is known as wire shoots. (Courtesy of Illinois Natural History Survey.)

from yellows in that fruit on affected trees fails to ripen, or ripens late instead of prematurely, and there is less yellowing of foliage in the early stages of the disease. Trees affected with little peach appear stunted and compact or bushy, because of greater production of leaves on short spurs along the main branches. They do not produce the slender yellow shoots (wire shoots) on the trunk and main branches characteristic of yellows. Leaves on trees in advanced stages are apt to be curled by recurving of the midrib toward the twig, but the halves of the leaves are not as closely folded as in yellows. Fruit is usually

FIGURE 24.—Close-up view of willowy growth arising from a main limb of a peach tree affected with yellows. Note the slenderness of the twigs, the light color, the small size and abundance of leaves, and the dark spots on leaves. An almost normal water sprout is seen at the base of the limb at the right. (Courtesy of Illinois Natural History Survey.)

small and poor-flavored, and does not have the red color on the peel or in the flesh characteristic of yellows.

Little peach, like yellows, affects different species and varieties of plums, some with meager symptoms and some without symptoms.

The control for little peach is the same as for yellows.

RED SUTURE

Red suture, also, belongs to the yellows disease group. It has appeared in Michigan and in Maryland.

The leaf and tree symptoms of red suture are more nearly like those of little peach than like those of yellows. Leaves on affected trees are recurved, terminal growth is shorter than normal, and an abnormal number of short shoots bearing clusters of leaves arise along the main arms. In advanced cases there is some twisting of leaves, most leaves are lighter in color than normal, and the centers of trees appear open. As with yellows, the fruits on affected trees ripen several days early, the suture ripening first. Frequently the suture is unevenly swollen. On red-colored fruits, the tops of the ridges and bumps are blotched with dark red or purple. The flesh of the early-ripening portion is usually very soft and watery. The affected fruits are usually low in sweetness and insipid in flavor.

Very little is known of the host range of red suture, and insufficient tests have been made to determine whether the leafhopper which spreads peach yellows can spread red suture.

The control for red suture is the same as for yellows, but is less efficient because of greater difficulty of recognizing diseased trees. Trees may be diseased for a year or longer before they develop recognizable symptoms and during that time serve as a reservoir from which spread can take place.

In the infected area, red suture appears to be becoming more serious.

X-DISEASE

The X-disease was named for x, the symbol of an unknown quantity, because of its peculiar symptoms. Diseased peach trees appear normal until midsummer (the date varies with locality); then, within a few days, leaves on affected twigs, beginning near the base of the current season's shoots, progressively become pale in color, commonly roll upward, become brittle, and develop irregular yellow and red spots of varying size, some of which shrink and fall out. The number of leaves affected and the size of spots on individual leaves increase rapidly, causing affected shoots to become conspicuously colored. Leaves on affected twigs usually are shed progressively from the base toward the tip. Tip leaves seldom become affected, and remain on the tree. During hot weather, leaves often drop before the typical spots are well formed. Fruits on affected twigs usually shrivel and fall soon after leaf symptoms develop. Fruits on twigs where leaf symptoms develop late in the season may remain on the trees; but they ripen prematurely and have a bitter flavor, and their seed fail to develop.

Diseased twigs or branches, even though they shed their leaves, do not always die. If they survive they leaf out apparently normally the following spring; then the sequence of symptoms is repeated. The disease usually begins on only one or a few twigs and spreads ir-

regularly through the tree, often taking several years to affect the greater part of it. Unlike some of the other viruses affecting peach, the virus causing X-disease seldom becomes distributed through the whole tree. Normal-appearing twigs on diseased trees are free of the virus and produce normal fruit. Affected trees under 3 years of age frequently die; older trees, although they become unproductive, usually do not die as a direct result of X-disease.

Besides peach, the X-disease virus infects cultivated cherries (both sweet and sour) and several wild plum and cherry species. The most commonly affected wild host is the chokecherry (*Prunus virginiana*). This plant is widespread in northeastern United States and adjacent areas of Canada and forms dense woodland and fence-row thickets. The disease appears to have spread rapidly in this host from where it was first seen in New England through New York, Ohio, and Michigan and into Wisconsin, Illinois, and Iowa. Diseased chokecherries prematurely develop varying degrees of autumnal yellow and red foliage color, beginning as early as June, and usually die in 3 to 4 years.

X-disease spreads to peaches chiefly from chokecherries. Eradication of chokecherries within 500 feet of peach orchards has been found sufficient to protect the trees from infection. Peach nursery plantings should be at least 500 feet from chokecherries and other wild cherry or plum species. Chokecherries can be effectively eradicated by spraying them with a water solution of ammonium sulfamate when they are in full leaf. The recommended strength is ¾ pound per gallon, and the recommended rate of application is 2 gallons of spray per 100 square feet. Sodium or calcium chlorate at the same strength is also effective. Atlacide, a proprietary material containing chlorates, is less dangerous and is effective if used according to the manufacturer's directions.

Sodium and calcium chlorates must be handled with care, since they are inflammable.

PHONY DISEASE

The phony disease is widely present in southeastern United States, particularly in Georgia and Alabama, where it has been the cause of serious losses. About 1,500,000 phony-affected peach trees have been removed from orchards in the State of Georgia alone.

The phony disease dwarfs peach trees, causing them to be darker green in color and more dense in appearance than normal (fig. 25). The dense appearance is due to an abnormal number of lateral twigs, with shortened internodes and a closer spacing of fewer but flatter leaves on the twigs. Symptom development is progressive; diseased trees become apparent in early summer as normal trees outgrow them, and are easily distinguished from normal trees by July. Fruit is smaller on diseased trees than on healthy ones and becomes progressively smaller each year of the disease. The phony disease does not kill peach trees, but affected trees are weakened and are more susceptible to winter injury and other orchard troubles. Trees that become diseased when young never reach productive orchard size.

The phony disease affects all peach varieties similarly. Its spread is rapid in some areas and increases in rate in proportion to the age of the trees and the number of diseased trees present. The wild chickasaw plum (*Prunus angustifolia*), which occurs in thickets all

through southern United States, has been found naturally infected near phony-affected peach orchards in Georgia.

Phony-affected peach trees should be destroyed promptly. Surveys have shown that spread of the disease is less rapid among the remaining trees where diseased trees have been removed. In infected areas, wild plums should be eradicated from the vicinity of peach orchards. Quarantines covering the infected area prohibit the growing of nursery stock within 1 mile of diseased trees.

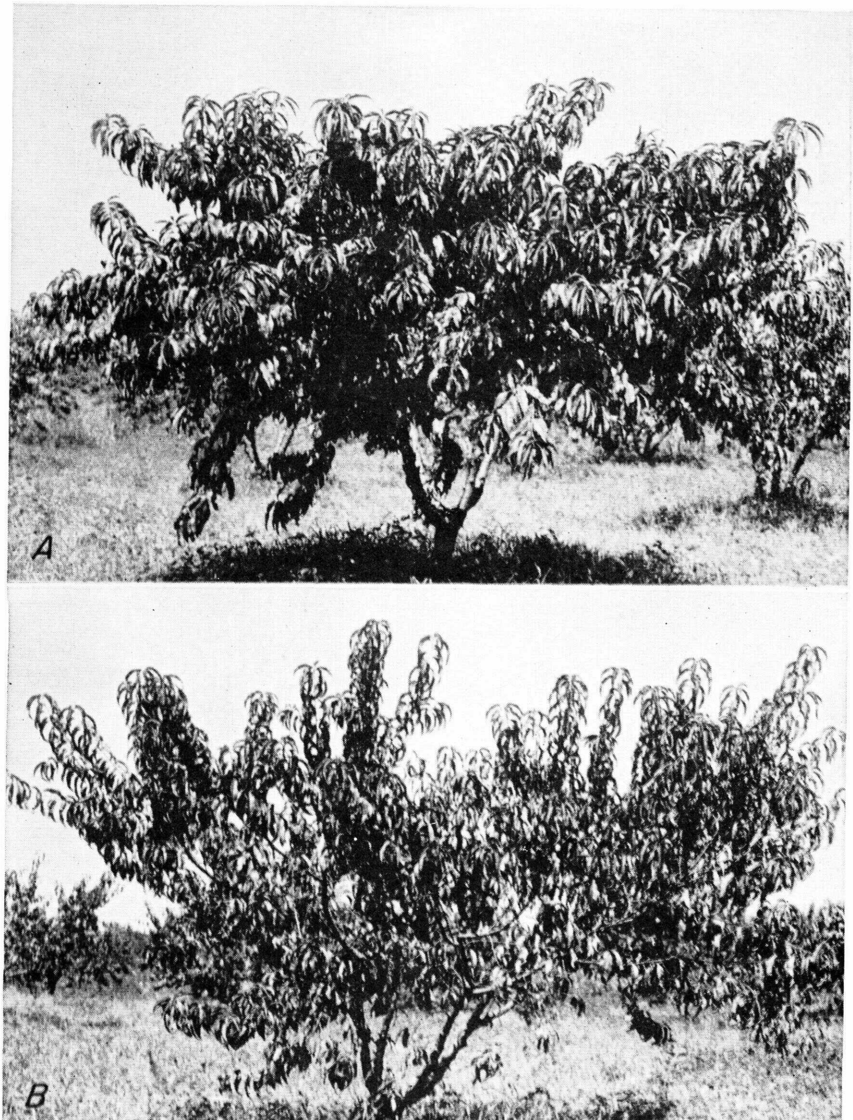

FIGURE 25.—*A*, Phony-affected Elberta peach tree at Fort Valley, Ga.; *B*, normal Elberta tree in the same orchard.

PEACH ROSETTE

Peach rosette is another virus disease affecting peach in southeastern United States. It is a very rapid killer and has caused severe local losses in areas where diseased trees were left standing.

Symptoms on peach generally appear in spring or early-summer growth. The first-formed leaves turn yellow, and shoots fail to elongate. Later-formed leaves are small and, because of shortened stems, grow into tight rosettes (fig. 26). Yellowing and shedding are progressive from older to younger leaves. Trees affected throughout usually die before the end of the growing season. Trees partially affected may live into the second year, but die by the end of that season. Spread may be rapid and the disease usually occurs in close colonies. The chickasaw plum occasionally becomes infected. Symptoms on it are similar to those on peach.

Peach rosette can be efficiently controlled by prompt removal of diseased trees in and near the orchard.

FIGURE 26.—Orchard tree affected with peach rosette and showing typically rosetted foliage. Such a tree usually dies before the beginning of the next season.

Peach mosaic occurs in southwestern United States, as far east as eastern Texas, southern Oklahoma, and western Arkansas, and in Mexico. It has caused serious losses both directly by crop reduction and indirectly by necessitating removal of diseased trees.

As the name implies, the most common and diagnostic symptom of the peach mosaic disease is the mottled patterns of yellow and green in the leaves. Peach varieties are equally susceptible to infection, but some are more seriously damaged than others. Varieties such as J. H. Hale (or those with J. H. Hale heritage), Elberta, Rio Oso Gem, and Fay Elberta are severely injured, whereas most clingstone varieties endure the most severe forms of the virus with only moderate damage. Newly infected trees of the J. H. Hale variety are retarded in the spring and develop small, narrow, deformed leaves with various irregular mottled patterns (fig. 27). As the season progresses the mottling becomes less distinct, but the trees are variously dwarfed and the fruit is variously bumpy and misshapen. Symptom expression on peach is complicated by the existence of forms of the virus, some of which are more damaging than others. Damage is more severe in cool climates.

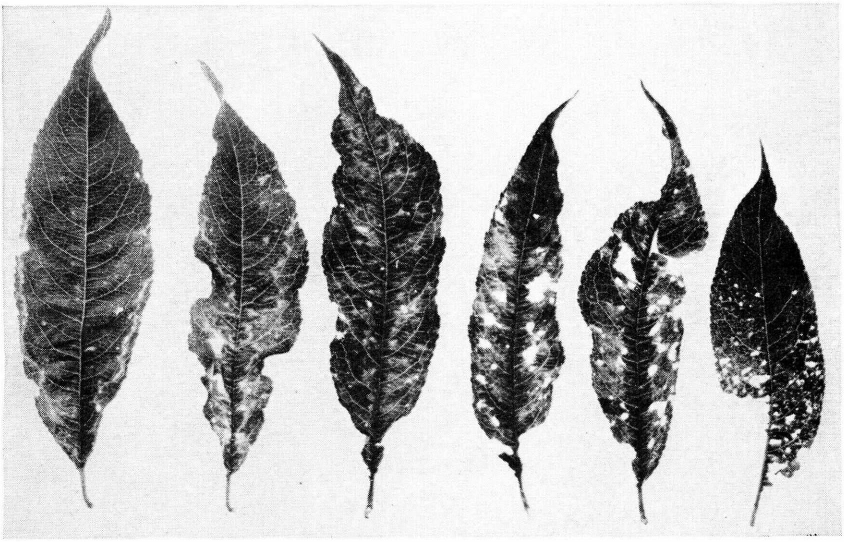

FIGURE 27.—Leaves of J. H. Hale peach affected with peach mosaic. The symptoms vary from marginal bands in the first leaf at the left to shot hole and veinlet clearing in the one at the extreme right.

The peach mosaic virus has been found widely existent in certain wild stone fruits including the chickasaw plum, wildgoose plum (*Prunus munsoniana*), and American plum (*P. americana*), as well as in certain cultivated stone fruits. Some of these hosts act as symptomless carriers. The rate of spread from peach to peach is more rapid in some areas than in others.

In areas where the severely reacting peach varieties are preferred, losses from peach mosaic can be reduced to less than 1 percent per

year by removing diseased trees and excluding little-damaged varieties in which diagnosis is difficult. In areas where the disease spreads rapidly and where wild hosts are prevalent or the loss that would be involved in removing diseased trees makes such procedure economically impractical, tolerant varieties can be grown. Since orchards of Elberta, J. H. Hale, and progenies of these varieties make up a large percentage of the freestone acreage in the United States, strong safeguards should be maintained to prevent spread of the peach mosaic disease to noninfected areas. Infected areas are now under quarantine, which prohibits sale of peach nursery stock grown within 1 mile of infected trees or from budwood taken from trees within 1 mile of infected trees.

ROSETTE MOSAIC, RING SPOT, NECROTIC LEAF SPOT, LINE PATTERN, AND ASTEROID SPOT

Several virus diseases affecting peach in eastern United States cause only minor crop losses. Of these the most serious is rosette mosaic, now known in Michigan and New York. This disease causes mottling, dwarfing, and rosetting of the foliage and a corresponding reduction of tree vigor. The ring spot virus retards spring growth and causes light-colored and ring patterns on leaves. Sometimes ring spot causes killing and splitting of peach tree bark. Symptoms of ring spot are usually present only during the first growing season after infection; infected trees appear to recover, but retain the virus without symptoms in succeeding years. One of the chief losses from this disease takes place in the nursery through failure of infected buds placed on healthy peach seedlings. The virus exists more commonly in plums and cherries than in peaches. Necrotic leaf spot differs from ring spot in that it produces no symptoms in the spring but produces dead spots recurring annually in leaves expanded in midsummer. Line pattern is primarily a plum disease, which is commonly present on Japanese-type plums, but peach has been infected with the line pattern virus through budding, with the result that obscure, mottled patterns were produced. Asteroid spot in peaches is common in Texas and westward. It produces small star-shaped spots of varying size scattered over the leaves.

PEACH INSECTS [6]

The common insect pests of the peach east of the Rockies are the plum curculio, the peach tree borer, the San Jose scale, the oriental fruit moth, and a group of sucking bugs including among others the tarnished plant bug and certain species of stinkbugs.[7]

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[6] This section was prepared by B. A. Porter. More complete general information on peach insects is available in Farmers' Bulletin 1861, Insect Pests of the Peach in the Eastern States. More detailed information on various peach insects and on new insecticides, applying to local conditions, can be obtained by the grower from his State agricultural college or extension service or from his county agricultural agent or farm adviser.

[7] The scientific names of the insects listed are as follows: Plum curculio, *Conotrachelus nenuphar* (Hbst.); peach tree borer, *Sanninoidea exitiosa* (Say); oriental fruit moth, *Grapholitha molesta* (Busck); San Jose scale, *Aspidiotus perniciosus* Comst.; tarnished plant bug, *Lygus oblineatus* (Say).

Many of the chemicals used for insect control are poisonous to man, or irritating to the human respiratory tract. Persons unskilled in handling these substances should obtain the advice or supervision of experts before attempting to use them. Poisonous materials should be stored and handled with care. They should be kept in tightly closed, plainly labeled containers, in places where they cannot contaminate food or be mistaken for flour or other food material or for medicines and where they will not be accessible to children, pets, or livestock. Adequate measures should be taken for the protection of operators who apply these materials.

PLUM CURCULIO

The plum curculio is a small beetle which hibernates in trash in or near the orchard. Early in the spring the curculios move into the trees. If they come from outside the orchard, they appear first on trees in the outer rows and later move to other parts of the orchard. The curculios lay eggs in small peaches soon after the fruits form. The larvae, or grubs, feed within the fruit for several weeks (fig. 28).

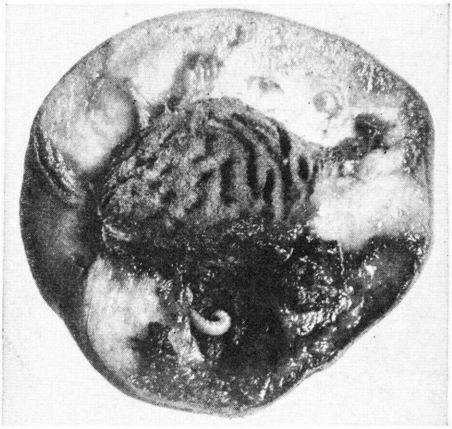

FIGURE 28.—Curculio grub and its injury to ripe peach.

In the South a second generation infests midseason varieties such as Elberta.

The curculio may be controlled fairly well by spraying with lead arsenate (a white powder colored pink as a warning) at a strength of 2 pounds per 100 gallons of water (3 rounded teaspoonfuls per gallon). To this should be added twice as much hydrated lime. Wherever a fungicide is needed, it may be used with the lead arsenate.

Because the history of the curculio varies according to seasonal and local conditions, the procedure for control varies among seasons and localities. Usually, the insecticide is applied during the month following petal fall. Where two generations occur in a season, one additional spray application is made, usually 1 month before picking time.

Because of the low effectiveness of lead arsenate and its tendency to injure peach leaves and wood, many experiments are being made with other spray materials of possible value. Several of the new insecticides that have shown unusual promise are now being used by many peach growers.

The peach tree borer is a white worm, about an inch long, which works underneath the bark near the ground line, often injuring the tree seriously or even killing it. The leading methods of control are digging the borers out by hand, applying paradichlorobenzene crystals, and applying an emulsion of ethylene dichloride or propylene dichloride. In some areas a trunk spray containing DDT is used.

Avoid working with these materials in poorly ventilated places.

The first-mentioned control method is tedious, and may result in more extensive injury to the tree than the borer infestation unless the cutting is done with great care. The paradichlorobenzene crystals are applied in a ring 1 or 2 inches from the base of the tree and covered with a mound of earth. From 1/4 to 1 1/4 ounces or more should be used per tree, depending on tree size, at a time ranging from about September 1 in New England to late October in southern Georgia. In the South paradichlorobenzene often causes serious injury to young peach trees up to 4 years of age. Ethylene dichloride emulsion is applied to the soil near the base of the tree (fig. 29) and then covered with a low mound of soil. Ethylene dichloride, especially in most southern localities, is less likely to injure the tree than paradichlorobenzene. Propylene dichloride is used in a similar way.

FIGURE 29.—Pouring ethylene dichloride emulsion onto the soil near the base of a tree for control of the peach tree borer.

SAN JOSE SCALE

The San Jose scale is a tiny insect which lives under a very small, inconspicuous scalelike covering. It sucks sap from the tree, and if very abundant weakens or kills large branches or even entire trees. The San Jose scale is readily controlled by thorough applications of either lime-sulfur or oil emulsion during the period when the trees are dormant. (See warning, p. 51.) Lime-sulfur should be used at a strength of 1 part of concentrated lime-sulfur (32° to 33° Baumé test) to 7 parts of water. Oil emulsion should be used at a strength of 3 percent of actual oil. Lime-sulfur is usually less effective in scale control than oil emulsion, but has the advantage of controlling peach leaf curl.

ORIENTAL FRUIT MOTH

The oriental fruit moth has spread to nearly all peach-producing sections east of the Rocky Mountains. Early in the season the larvae tunnel into new peach shoots and later on they infect the fruit (fig. 30). This pest is especially serious on the varieties that mature at

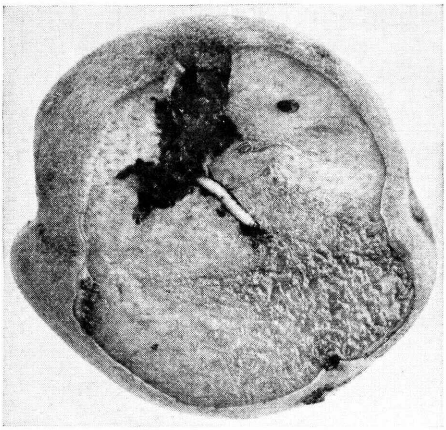

FIGURE 30.—Larva of the oriental fruit moth and its injury to peach fruit.

midseason or later. Control of the oriental fruit moth has been especially difficult. Certain parasites have proved useful in keeping down the worm damage, but do not control the worms adequately in all seasons or all localities. DDT and other new insecticides that have given promising results are now being used commercially.

SUCKING BUGS

The tarnished plant bug and several other species of sucking bugs feed on peach blossoms and on newly formed peaches, causing the fruit to become seriously scarred and distorted (fig. 31). These bugs live and feed chiefly on weeds or field crops in or near the orchard, and work on peaches for only a short period in the spring. Where it is consistent with good horticultural practice, eliminating weeds and certain cover crops aids considerably in control. In recent years sev-

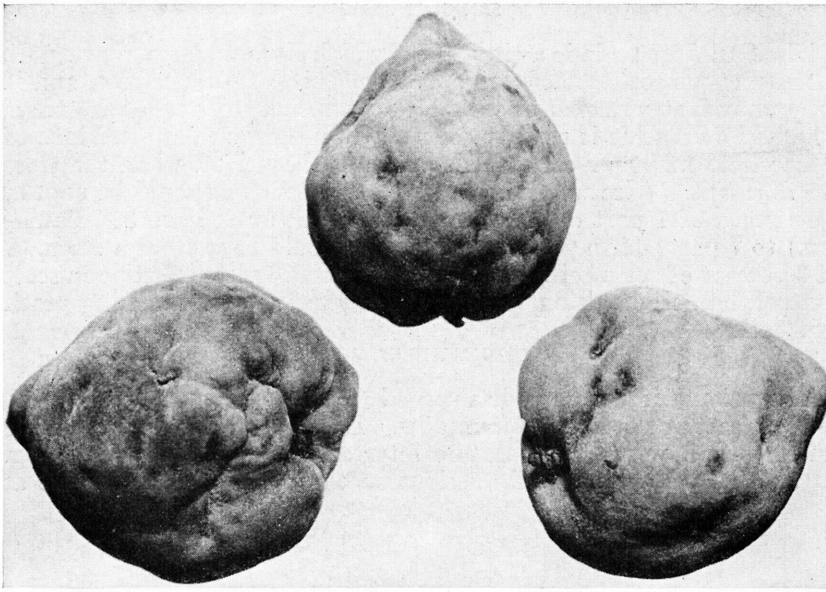

FIGURE 31.—Injury to peaches caused by sucking bugs.

eral experimenters have reduced damage to peaches by the tarnished plant bug, at least, by spraying the trees with DDT immediately before they bloomed or just after the petals fell.

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